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TO THE

MINERALOGY OF VICTORIA.

BY

GEORGE H. F. ULRICH, F.G.S.

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TO

THE MINERALOGY OF VICTORIA.

It has frequently been noticed by persons acquainted with other mining countries that our colony, though well-explored and studded with well-developed mines, is very poor in minerals, both as regards variety and beauty of crystallized specimens. We can certainly not complain of the quantity and intrinsic value of the principal minerals we possess, considering that our quartz reefs and tertiary drifts furnish the most valuable of metals in greatest abundance—(an authority like Sir Roderick Murchison proving Victoria to be the richest gold-mining country in the world—*see* "Siluria," 4th edition)—and that the most precious of gem-stones—*diamond* and *ruby*—have already been discovered, and the number of new varieties of other known species is steadily on the increase. Victoria has indeed received, so to speak, the very essence of mineral riches; yet, in looking, for instance, at the inconsiderable number of different mineral species—about twenty—hitherto recognized in the hundreds of auriferous lodes opened throughout the country, and comparing this result with the many dozens of fine minerals occurring in the ore-lodes of Cornwall, Saxony, the Hartz, &c., the reward for mineralogical research appears rather a meagre one, and any new discovery is therefore the more eagerly welcomed and deserving of record.

Finding some pleasure in the study of this branch of science, I gave, in the geological essay prepared for the Intercolonial Exhibition of 1867, a condensed description of the mineral species up to that time found in Victoria; and as a number of new finds and facts have come under my notice since that publication, it might prove both of scientific and general interest if I record progress in the following pages. Not only have species *quite new to Victoria* to be noticed, but also several *quite new to science*, and of those already known, new localities, new interesting forms of occurrence, &c., deserve mention. My enumeration, I am conscious however, will even fall short of the mark, for, through the untiring energy of the Secretary for Mines, Mr. Brough Smyth, in securing the saving, transmission, and examination of specimens from all parts of the colony, the list of new species and varieties is nearly daily augmented.

Having myself no laboratory at command, I am specially indebted to my friend Mr. Cosmo Newbery for his assistance in furnishing me with the chemical analyses of a number of the species described.

For crystallographers I have drawn correct figures of some of our interesting crystal rarities, and given in the context accurate measurements of angles for the determination of the indices of the planes of some of the new crystals.

As regards the arrangement of the species in the description, no system has been followed, except that of grouping together the native metals and metallic minerals—the hydrous and anhydrous oxides—the salts of special acids—gemstones—silicates—sulphates, and carbonates.

MALDONITE OR BISMUTHIC GOLD.

Some time ago my attention was directed by Mr. Salter, the manager of the Alliance Company, Nuggety Reef, Maldon, to small irregular specks of a rare gold-ore that occurs associated with gold, generally in the neighborhood of, and sometimes several inches deep in, the granite veins that traverse this interesting reef. The miners call this ore "black gold," on account of the mostly dark-looking specks producing globules of bright gold by the usual burning or roasting of the quartz. Of the small quantity—a few implanted specks—available for examination, I was only able to make some blowpipe experiments; but these were sufficient to prove the ore to be an alloy of bismuth and gold. It fuses very easily on charcoal, and whilst imparting to the latter the characteristic yellow coating of bismuth, turns gradually to a bright gold bead. Sulphur, tellurium, &c., which, from analogy, I supposed to be present in the ore, are entirely absent. From a number of specimens, lately received through the kindness of Mr. Salter, another small quantity of the ore was obtained that sufficed Mr. Cosmo Newbery for a qualitative analysis and an assay of hardly half a grain. The former of these confirmed my blowpipe determination, and the latter proved the composition of the ore to be Au 64·5, Bi 35·5, conforming closely to the chemical formula $Au^2 Bi$. Other characteristics of the mineral are:—hardness, 1·5–2·0; malleable; very sectile; very bright metallic lustre and pinkish silver-white color when freshly broken, but tarnishing gradually on exposure, first to a dull copper color, and ultimately to black. Crystals have not been observed as yet; cleavage apparently cubical. Two trials to determine its specific gravity, made with two specks weighing considerably less than one grain each, produced, singularly enough, the one only 8·2, the other 9·7, though, according to the above composition of the ore, it should have been considerably higher. In order to find the reason of this discrepancy, the two test-samples were dissolved in *aqua regia*, when it was discovered that each contained inside a fine skeleton of an earthy mineral, resembling felspar under the microscope, though no trace of this could be detected previous to the trials. This ore, as a natural product, is quite new to science—the *bismuthaurite* described by Shepard being a furnace product—and it is therefore proposed to name it "*Maldonite*," after the locality of occurrence. Mr. Salter states that it was formerly found—in the upper workings of the Alliance Company's mine—in greater quantity and in larger pieces, and it is therefore not improbable that it might also occur in a similar manner in the neighboring ground of the Speculation Company, perhaps in crystallized pieces, and affording sufficient material for a quantitative analysis. It was no doubt the source of the former frequent admixtures of bismuth in the gold from the Nuggety Reef.

TETRAHEDRITE.

On examining several fine gold-quartz specimens from the Albion Company's mine, Steiglitz, kindly shown to me by Mr. Davidson, of Geelong, I discovered bright, grey metallic specks, and in a hollow of the quartz also a perfect tetrahedral crystal of an ore, that, before the blowpipe on charcoal and in the glass tube, proved to be *Tetrahedrite*, giving reactions for S, Sb, As, Cu, Fe, and Zn, and which may also contain Ag.

This ore is quite new to Victoria. It is associated with *gold*, *iron pyrites*, *stibnite*, and, though rarely, *bournonite*. On breaking one of the specimens, several smaller crystals were afterwards discovered in hollows of the quartz, coated by *pholerite*. They show a fine iridescent tarnish and brilliant lustre, and are very rich in planes. The solitary perfect crystal, of which a drawing (Fig. 1) is annexed, exhibits those of the cube *h*, octahedron *o*, rhombic-dodecahedron *d*, trapezohedron *t*, and of the rather rare hexakisoctahedron *m*.

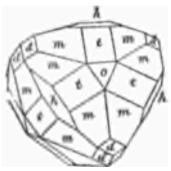

FIG. 1.

BOURNONITE.

This ore has been known since several years to occur very rarely in some quartz reefs of Ballarat, St. Arnaud, and Heathcote; we can now, however, add to these another locality, viz., the Albion Reef, Steiglitz, in which it is apparently found in some abundance. This is shown by two lots of specimens from the Albion Company's mine received at the former Geological Survey Office for examination—one sent by the mining surveyor, the other by the manager of the mine. The ore occurs more or less thickly dispersed through the quartz in small patches, crystalline grains, and minute crystals, which latter are generally coated by *pholerite*. A crystal nearly perfect at both ends, though only 1½ lines in length, was found in a small hollow, and shows the form given in Figs. 1 *a* and *b*. The mineral is associated with *gold*, light-brown *zinc blende*, *iron pyrites*, tufts of acicular crystals of *stibnite*, and rarely *tetrahedrite*, from which latter, if not crystallized, it can hardly be distinguished by outward appearance; however its behaviour before the blowpipe on charcoal demonstrates clearly the presence in it of lead, which is absent in the other, and thus affords an easy mode of recognition.

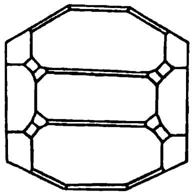

FIG. 1 *a*.

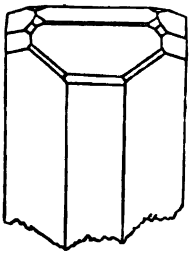

FIG. 1 *b*.

NATIVE BISMUTH, BISMUTH-GLANCE, AND BISMUTHITE.

These three minerals, of which the second is rather rare and quite new to the colony, were lately discovered in a quartz reef at Linton, Ballarat district. Mr. C. Newbery first examined and analyzed specimens, and made their composition known in the *Ballarat Star*. On the specimens from the reef that came under my notice, I found *native Bismuth* and *Bismuth-glance* associated with *gold*, and *iron* and *copper pyrites*. The first formed small irregular specks, the *Bismuth-glance* scaly and slender prismatic crystals of fibrous or foliated structure, and showing an iridescent tarnish—some very similar in appearance to sulphide of antimony. The *Bismuthite* appears to be rather scarce, and may also, on account of its greyish color and earthy aspect, be easily overlooked. Mr. Newbery discovered it only after pounding some quantity of the reef-stone. A fine sample of this mineral was lately presented to me by Mr. Ed. Dunn, an ardent collector of mineral specimens, and discoverer besides this of many other interesting novelties in this line in the Beechworth district. It occurs in the gold-drift near Beechworth, in roundish nodular grains of greyish or yellowish-white color; in fact, it is in all respects similar to that I discovered several years ago in the washdirt of Ramshorn gully, Sandy Creek, Tarrangower. Mr. Dunn found pieces up to half an ounce in weight with a centre of metallic bismuth, and also in the same deposit small pieces of *native Bismuth*, one with angular fragments of quartz attached: all which occurrences lead to the conclusion that the *carbonate* is a product of chemical change of the native metal, and that the latter, or perhaps both minerals, have originally been derived from a quartz reef in the neighborhood.

NATIVE COPPER.

This metal has been found at three new localities:—

1. At Clunes, in the older pliocene gold-drift of the Clunes Company, in small specks and nuggety water-worn pieces, evidently like the gold derived from some lode hidden beneath the basaltic lava that occupies a vast surface area of that district.

2. In the ground of the Rodney Gold Mining Company, between Ballarat and Creswick, at a depth of 185 feet from the surface in the reef drive, 35 feet beneath the gold-drift. It occurs in the line of contact of alternating beds of bluish soft slate and sandstone, but attached to the former, in filiform and arborescent shapes—a mode of occurrence very similar to that I described from Wilson's Reef, St. Arnaud.
3. In the prospecting drives of the Flying Scud Gold Mining Company, Egerton, in a manner quite similar to that just mentioned.

STIBNITE (SULPHIDE OF ANTIMONY).

To judge from the numerous new discoveries of this ore since the last two years, it no doubt ranks next to arsenical and iron pyrites as the most frequent companion of gold in our quartz reefs, though it occurs also in separate veins not associated with auriferous quartz. The upper silurian rocks are however, as far as experience goes, richer in the ore than the lower silurian. Its market value having since some time considerably risen, the working of the separate veins and patches, or the saving of the ore occurring in auriferous quartz reefs, which goes on concurrently with that of the gold, has now become a source of considerable income to small parties of miners and several mining companies, especially in the Heathcote Mining District.

As the more important amongst the new discoveries, have to be mentioned strong veins of the ore at Munster Gully (Dunolly); Donovan's Creek; Upper Yarra; Yea, and Sunbury; and detailed descriptions of the latter, as also of the veins of Costerfield (Heathcote district), by Mr. Th. Couchman, are given in Mr. Brough Smyth's work, *The Goldfields and Mineral Districts of Victoria.*

A discovery of later date are two strong veins of the ore—not associated with auriferous quartz—at Ringwood, about fifteen miles from Melbourne on the road to Lillydale. From inspection I can state about these as follows:—The first and largest vein—discovered by accident through the breaking of road metal from the top of a rise, a few chains west of the road—is from 2 to 4 feet wide, strikes N. 7° W., and dips westerly at angles varying between 60 and 70°— these data being the means in the line of the workings, which have an extent of about two chains. In its special behaviour the vein, like its congeners all over the world, is very uncertain and irregular, *i.e.*, especially liable to turn and form patches, which are, however, always connected by a strong ferruginous casing or mullocky band, carrying *antimonial ochre* in veins, and finely disseminated. At the bottom of one of the shafts, 31 feet deep, it strikes, for instance, N. 7° E., and dips at the shaft 65° west, some 10 feet farther south 70° W., whilst its thickness of nearly 4-feet of solid ore, some distance up the shaft, has dwindled down to a few inches—the walls of the lode, from 1½ to 3 feet apart, being filled up with mullock, enclosing, besides the narrow vein, nodular pieces of the ore, and *antimonial ochre* in thin strings and small patches. A few thin leaders of ore join here the main vein from the east.

The second vein, discovered by Mr. Finnie, crosses the Melbourne road at an oblique angle about three and a half chains distant from the workings on the former vein, the southern continuation of which it ought to intersect close to the road. It strikes in the workings on north side of road N. 30° E, on south side N. 35° E., and dips easterly at angles varying from 60° to 70°. As far as at present opened, by a trench and a short drive in a shallow shaft, it is from 1 to 2 feet thick, and appears to be even more irregular in its behaviour than the first vein, having as yet only furnished its orey product from small disconnected strings, and as a number of lumps—some from close to the surface; the remaining portion of it consisting of ferruginous mullock, rich in *antimonial ochre.*

Both veins traverse thick-bedded, yellow, in places highly ferruginous, upper silurian sandstone, which strikes N. 20° E., and dips easterly at an angle of 64°.

Speaking generally about *Stibnite*, it is a singular feature, considering the more and more proved abundance of the ore, and in comparison to other mining countries, that crystallized specimens are as scarce as ever. As new in this respect, I can only mention that groups of small acicular crystals have been observed at Costerfield—as a great rarity—partly in hollows within the mass of the ore, partly on the faces of joints in the walls of the lode.

MOLYBDENITE.

Of this mineral four new places of occurrence have to be mentioned, viz : Yea, the Bradford Lead and Nuggety Range (Maldon), and Mount Moliagul. At Yea, it is found in a coarsely crystalline variety of granite, agreeing, as regards composition, with that called "*greisen*" in Germany—a mixture of only mica and quartz, felspar being absent. More or less regular hexagonal plates of the ore, some nearly 1 inch in diameter, are in great abundance irregularly distributed through this rock, and, curiously enough, in such a manner that they generally lie between the mica partings of the quartz fragments, and are seldom embedded by themselves in the solid quartz.

At the Bradford Lead, Maldon, the mineral occurs very sparingly; but the specimens hitherto found are rather interesting, consisting of pebbles and crystals of *cairngorm* and *rock crystal*, in which spangles and small hexagonal plates of *Molybdenite* lie embedded—an occurrence rarely recorded.

In the Nuggety Range (top of high hill above the Maldon Cemetery) it was lately found, by Mr. Rule, dispersed through a quartz vein traversing granite. It occurs in hexagonal plates, up to half an inch in diameter, and is associated with *orthoclase*, *schorl*, *mica*, and *wolfram*. Fine druses of *rock crystal* and *cairngorm* are also not rare in the vein.

The fourth new discovery of *Molybdenite* was made a short time ago, in a quartz reef running across the slope of Mount Moliagul. It occurs in small plates disseminated through the quartz, and forms also drusy accumulations of imperfect scaly crystals in open joints of the reef. It has apparently undergone much decomposition, as the faces of the joints in the reef are mostly covered with narrow slits and hollows—partly empty, partly filled with fine quartz sand and clay—that evidently have originated through the removal of *Molybdenite* crystals. The joints of the quartz are, as a further evidence of the decomposition of the ore, coated with—

MOLYBDIC OCHRE.

A mineral new to Victoria. It forms small light-yellow tufts and nobs, which, by aid of the magnifying glass, prove to be composed of a dense accumulation of fine, silky, radiating needles, not unlike the manner in which malachite is often found. This mode of occurrence of the mineral in capillary crystallizations appears to be very rare. In Nicol's, Brooke and Miller's, and other mineralogies consulted, it is described as a yellow, earthy substance or incrustation, and in this latter form it actually occurs, though sparingly, in hollows of molybdenite specimens from Yea. Only in the new edition of Dana's *Mineralogy*, 1868, it is mentioned as occurring in the capillary crystalline form.

CERVANTITE (ANTIMONIAL OCHRE).

This mineral being always associated with the *sulphide of antimony* (through the decomposition of which it has no doubt arisen) above the permanent water-level of the respective lodes, it is likewise found at all those new localities mentioned for the latter. Though sometimes filling, as a yellow powder, cavities in the *sulphide* and gangue, it is mostly dense and hard, generally isabella-yellow, sometimes greenish-yellow and yellowish-white, and shows often, especially the crust round nuclei of *stibnite*, concentric rings varying in the different shades of color just mentioned. In the veins at Ringwood, it occurs in places in thick, massive, seam-like patches, sometimes with a laminated structure, rendering it hardly distinguishable from the mullocky gangue, occupying portions of the lodes. Dense pieces show frequently a porphyritic aspect, caused by small perfect quartz crystals being more or less thickly distributed through the mass. Specimens with acicular crystallizations, from Costerfield, have come under my notice as great rarities.

CHROME OCHRE.

Specimens of this mineral, similar to those occurring at Heathcote and Strathloddon, have been kindly shown to me by Mr. Couchman, Chief Mining Surveyor, as from the Great Western diggings, Pleasant Creek. It might be described as a rather soapy clay, colored dark pistachio-green by sesquioxide of chromium, which has no doubt resulted from the decomposition of "*chromic iron*," of which black grains, rather friable and devoid of lustre, can be recognized scantily distributed through the clay.

WAD, ASBOLITE (EARTHY COBALT).

In my former description of Victorian mineral species (Exhibition Essays, 1867) I was obliged, from their hardness and general resemblance, to place under the head of "*Psilomelane*" the varieties of ferruginous black manganese-ore occurring so abundantly on the goldfields and in other parts of the colony, although the compositions of the specimens analyzed, varied, not only greatly amongst themselves, but differed still more from those recorded for *psilomelane* from European and other localities. The great amount of oxide of iron contained in the Victorian specimens appeared to be their chief distinguishing characteristic, and I therefore proposed the name of *black ferro-manganese-ore* for them. Seeing, however, in the recent edition of Dana's *Mineralogy*, that ores of a hardness varying from 0·5 to 6, and of the most diversified compositions, are placed under the general head of "*Wad*" as being no defined mineral species, I think the Victorian specimens formerly analyzed would, with perhaps one exception, which agrees pretty closely with true *psilomelane* in composition, come under this head also; whilst an ore of this class since found by Mr. Verdon, at Home Creek, Sloane's Punt, Goulburn River, would belong to the sub-species *Asbolite* (*black Earthy Cobalt*), as it contains, according to Mr. Newbery's analysis, 14 per cent. of oxide of cobalt. It occurs in irregular strings and seams of nodular, mammillated masses in the upper silurian shales, and forms also botryoidal coatings on the faces of joints in the beds.

BROOKITE (ARKANSITE ?).

Mr. Murray, of the former Geological Survey, forwarded some time ago a number of specimens from a quartz reef in the Steiglitz Mining District, which contain a hard, brown, or chocolate-colored opaque mineral, forming thin veins or layers in joints of the quartz. The faces of these layers are irregularly striated, and show a metallic adamantine lustre, and the powdered mineral is of light-yellow color, and proves before the blowpipe and by qualitative analysis, to consist of pure titanic acid. As there are three minerals known to be composed solely of this acid, viz., *rutile*, *brookite*, and *anatase*, each of distinctive crystalline form, it might, in default of crystals of the mineral under notice, be considered rather hazardous to term it *Brookite*. In justification of this course I can, however, plead that I have seen in several European mineral collections undoubted specimens of *Brookite*, in all particulars resembling the Steiglitz mineral, none, however, of *rutile* and *anatase* that were similar to it.

On some of the specimens places can be noticed, where the brown color of the mineral is changed to greyish-black with quite a metallic lustre, and that afford a greyish-black streak-powder. As these portions also consist of titanic acid, as proved by experiment, they would, according to Dana's description, agree with the variety of *Brookite* occurring in Arkansas and other American States, and named by Shepard "*Arkansite*."

Small, thin, plate-like particles of *Brookite*, in color, striation, lustre, &c., exactly resembling the Steiglitz mineral, occur also in the gold-drift of the Mount Greenock Lead, associated with *sapphire*, *topaz*, *zircon*, &c.

CASSITERITE (TIN-ORE).

Although this valuable ore has long been known to occur in workable quantity in the state of more or less fine sand, with occasional larger pieces—so-called "*stream-tin*"—in the gold-drifts of many of our goldfields, more especially Beechworth, still all research and prospecting to find it in its rock matrix proved unsuccessful till, since last year, three such interesting discoveries were made at the last-named goldfield. The credit for the first, made above ten months ago, belongs to Mr. Ed. Dunn, who systematically traced the *stream-tin* of a gully situated about five miles S.W. of Beechworth, to have been derived from a peculiar brecciated porphyritic dyke, traversing granite. The dyke stone—intensely hard and tough—is composed of *chalcedonic quartz, felspar crystals*, and sometimes *mica*, and the *tin-ore* occurs distributed through it in small crystalline grains; other associated minerals are *iron pyrites*, and rarely *fluor-spar*. The dyke varies very much in character and width, and, on account of the hardness of the rock, has as yet not been properly prospected.

The second discovery was effected by Mr. Hensley, tinsmelter, at a place situated about four miles from Beechworth, in a south-westerly direction; and Mr. Dunn describes it as made in a strong surface-blow of cellular *quartz*, containing abundance of white *mica* in plumose and sometimes stellate aggregations, and lying in a large dyke of *eurite*, that traverses rather coarse-grained granite. A shaft, sunk by Mr. Dunn's advice at the end of the quartz-blow, disclosed the following:—The mass of quartz soon decreased in thickness and split into veins, whilst the stuff surrounding these consisted in places almost entirely of fine mica, but turned gradually to a reddish soft eurite. The quartz veins in this rock appear like lenticular patches, are full of *felspar*, and where their underlying faces rest upon the eurite, the *tin-ore* occurs in small crystals and grains, each one embedded in a felspar crystal. The quartz itself is very cellular, small crystals of it studding the inner walls of the cells, whilst occasional larger cavities are filled with a micacious mud, enveloping drusy pieces and perfect crystals, curiously developed. On account of a hard bar of rock, dipping to the east, having been struck in the bottom of the shaft, the sinking of the latter, as yet but twenty feet deep, has been suspended at present; but it ought certainly to be resumed, and the dyke more extensively explored, considering, besides its resemblance to a real *lode*, the favorable feature of the tin-ore occurring disseminated both through the *quartz* and *eurite*.

The third discovery of *Tin-ore* in rock matrix, which has created some excitement in the district, was likewise made in a very fine-grained (euritic) granite dyke traversing common granite, about three-quarters of a mile N.W. of Beechworth. According to Mr. Dunn, this dyke strikes about N. 15° W., and can be traced for a considerable distance on the surface, though it is very irregular in its course, in places disappearing in the granite and suddenly cropping out again. A casing, or other defined line of demarcation between it and the granite is entirely absent; the texture of the latter simply changes suddenly from coarse to fine-grained, and the *mica* disappears. Both kinds of rock are traversed by numerous thin (quartz) veins in such a manner as to impart the idea of some strong force having shattered their mass in all directions, the resulting cracks and joints being now represented by the veins. The *tin-ore* occurs in these veins both in the granite and dyke rock, but principally in the portions traversing the latter, and those appear to be the richest that cross the line of dyke at an oblique angle (N. 53° W.). It sits in small, often highly modified crystals—single and compound—on thin layers of quartz coating the walls of the veins, the interspaces being generally occupied by a very soft, scaly, greenish mineral, very much resembling *talc*, but conforming in its blowpipe reactions most to *pyrophyllite*. As associated ores—though most prevalent in the veins traversing the granite—have as yet been observed *copper*, *iron* and *arsenical pyrites*, and black powdery *sulphide of copper*. About two chains from the prospecting shaft (which is 26 feet deep at present), *garnets* of a reddish-wine yellow color have been found in some abundance.

Although it is as yet doubtful whether any of the three *tin-ore* occurrences just described, and of which the last one reminds much of the "*netzgänge*"—net-lodes of tin-ore of Altenberg, Saxony—will, on further exploration, prove of value, so as to pay working on a large scale, still—be the result favorable or otherwise—the established fact of this new mode of occurrence of the ore recommends at any rate a systematic examination of all the rich tin-bearing creeks of the district, and especially a sharp look-out for *euritic* and other dykes traversing the granite and silurian rocks, near the boundary of the latter: for it is highly probable, if not quite certain, that the *stream-tin* of all these creeks has similar sources as those described, and payable, perhaps rich, ones may be amongst the number.

MAGNETITE (MAGNETIC IRON-ORE).

Regarding this mineral, it has to be mentioned as new that Mr. Norman Taylor, field geologist, found minute octahedrons of it abundantly distributed through the basalt of a hill near Dr. Baynton's station (Geological Survey ¼ sheet, 51 S.W.). Bars cut from the rock were observed to possess perfect magnetic polarity. Grains of the mineral of a rusty-brown color, varying in size from dust to that of a pea, occur also abundantly in the drift of gullies running off the basalt of Horse Hill, same neighborhood.

WOLFRAM (TUNGSTATE OF IRON).

Fine specimens of this mineral, of more massive, coarsely-columnar structure than those known from Sandy Creek, Maldon, have lately been found in a quartz reef near Ballarat. Hollows in the quartz show sometimes crystals of it that are of a rather perplexing monoclinic-like development.

It has also quite recently been discovered by Mr. O. R. Rule in the quartz vein traversing granite in the Nuggety Range, Maldon, mentioned under *molybdenite*. It occurs in small tabular and columnar pieces embedded in quartz, associated with *scheelite*, *molybdenite*, *schorl*, *felspar*, &c.

SCHEELITE (TUNGSTATE OF LIME).

This mineral—quite new to Victoria—has been found at two different localities in the Maldon district. Our Public Museum collection of colonial minerals possesses one rather imperfect crystal, one-sixth inch in diameter, representing a somewhat compressed tetragonal octahedron. This crystal was quite by accident discovered by Mr. Newbery in a broken crystal of *smoky quartz* from the Bradford Lead. Though in color quite similar to the matrix, its faint outline, somewhat higher lustre on one exposed face, and being scratched by a knife, attracted attention, and on the quartz crystal being carefully broken, that of *Scheelite* was obtained. A small portion broken off during this operation served for determining its composition as *tungstate of lime*. The mineral is no doubt rare at the place, and may also, on account of its very close resemblance to its matrix—*smoky quartz*—be easily overlooked. Careful examination of a great number of similar quartz crystals and pebbles from the lead failed to disclose another specimen.

The second locality where this mineral occurs is in the quartz reef in the Nuggety Range above mentioned. I identified it in a specimen—kindly shown me by the discoverer, Mr. Rule—which contains it implanted in quartz in crystalline grains, and as one rather imperfect crystal of a quarter inch in diameter, closely associated with rather decomposed-looking *wolfram*—a feature affording a clue to its origin.

Considering that the drainage from the Nuggety Range, on which the above quartz reef occurs, is direct into the valley of the *Bradford Lead*, and that there is evidence of a formerly existing drift branch of same age as that of the lead, viz., *older pliocene*—leading from the range into the lead—having been removed by denudation, it is not at all improbable that those drift pebbles and crystals, enclosing *molybdenite* and *scheelite*, occurring in the lower portion of the lead, have originally been derived from this quartz reef.

VIVIANITE (PHOSPHATE OF IRON).

The earthy variety of this mineral—*blue iron earth*—has long been known from the basalt of Ballarat, from Point Addis, Geelong, and from several of the guano islands of Bass's Straits; but in a finely crystallized state it has only come under notice above two years ago, when Mr. W. Jahn, mining surveyor, sent specimens for determination to the Geological Survey Office, which he found in a soft, yellow, silurian sandstone from a digger's shaft on the Nicholson River, near Sarsfield, Gippsland. The mineral is of a light to dark sky-blue color, translucent bottle-green, but seems to become somewhat opaque on exposure to light. The specimens forwarded by Mr. Jahn, of which the best are now in the collection of our National Museum, show it to occur in veins from the size of a thread to about half an inch in width, also as crystals from one-eighth to above one inch in length, in cracks or open joints of the sandstone. The form of these crystals, shown in Fig. 3, is the common one observed on vivianite from Bodenmais and other places, the plane marked *P* being that, parallel to which a very perfect mica-like cleavage exists, whilst planes *M* and *Z* indicate this cleavage by longitudinal striæ. All the specimens show, associated with the *Vivianite* and in places covering it, small dull-yellow to dark greyish-brown wart-like nobs that consist of carbonate of iron—*sphærosiderite*—and may perhaps be products of decomposition of the *Vivianite*.

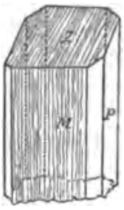

FIG. 3.

During the recent arrangement of the collection of colonial minerals at the National Museum, two specimens of *Vivianite* were noticed that, as regards size and perfection of the crystals, especially on one specimen, are hardly surpassed by any I have seen in European mineral collections. These specimens—taken to be *oblique green mica*, to which they have indeed great resemblance—have been presented to the museum by Mr. H. Stone, mining surveyor, who obtained them, according to the *Mining Statistics* of December 1860 (prepared by Mr. R. Brough Smyth, Secretary for Mines), on the Buckland River, in the cutting for a water-race. The largest of the crystals is about one inch and a half in length and three-quarters inch thick, and is represented in Fig. 4; it shows, in addition to the same prismatic planes of the Gippsland crystal, two pairs of rare terminal ones, which require to be measured. The color of the crystals is a deep bluish-green seen perpendicularly to the cleavage plane, and impure blue in any other direction. It is a singular fact that these specimens of *Vivianite* are, like the Gippsland ones, also associated with small nobs of *sphærosiderite*, and that they occur in a similar soft, yellow sandstone. Indeed the resemblance of the specimens from both localities is so close that anyone unacquainted with the facts would unhesitatingly pronounce them as coming from the same place.

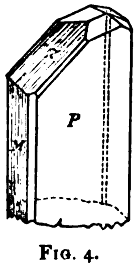

FIG. 4.

PHOSPHORITE.

On examining a reddish-brown basaltic clay (decomposed older basalt) from Bruthen Creek, Gippsland, it was found to contain nodular concretions of a whitish mineral substance, colored in places by blue and green *carbonate of copper*, and that proved to be a rather impure *Phosphorite*, according to the following results of a quantitative analysis by Mr. Cosmo Newbery :—

SiO_2	56·309
Fe_2O_3	2·579
CaO	17·354
PO_5	15·894
$CaO.CO_2$	7·954
	100·090

CaO and PO_5 stand in the proportion to each other to form the tribasic phosphate (*apatite*). SiO_2, Fe_2O_3, and $CaO.CO_2$ may be considered as impurities, as their percentage varies in different samples. Some of the specimens contain a much larger percentage of SiO_2, which is generally so intimately mixed with the phosphate and carbonate that it cannot be separated by any mechanical process.

WAVELLITE.

This mineral, hitherto not known in the colony, was discovered by Mr. Norman Taylor, geological surveyor, about two miles north of Lancefield, in lower silurian graptolite shales. It occurs, covering the bedding planes of the shales in the characteristic yellowish or greenish disc-like plates with finely radiated structure, exactly similar to the specimens from Devonshire, Bohemia, Saxony, and other places. In addition to this structural coincidence of the mineral with *Wavellite*, its identity with it is put beyond a doubt by its behaviour before the blowpipe, and in the moist way, viz., by giving clear evidence of the presence of phosphoric acid and alumina.

STRUVITE.

During a recent exploration of the Skipton caves near Ballarat, Messrs. Etheridge and Murray, geological surveyors, collected samples of the guano that, to a considerable depth—perhaps 20 feet or more—covers the bottom of the caves, being apparently in a great measure derived from the excrements of thousands of bats which use the caves as hiding places in daytime, when they can be observed hanging in large clusters suspended from the roof. The guano has a rich-brown color, and is full of light-yellow, subtransparent, crystalline particles and glistening, perfect crystals of a mineral that experiments prove to be *Struvite*. Before the blowpipe it imparts to the flame the characteristic bluish-green color of phosphoric acid, and fuses easily to a white enamel, which assumes a fine purple color with solution of cobalt. Heated in the closed tube it becomes white opaque, whilst giving off water and fumes of ammonia. A bluish-green color imparted by it to a soda bead proves the presence of manganese.

According to a quantitative analysis made by Mr. Edward Pittman, under the direction of Mr. Cosmo Newbery, at the Geological Survey laboratory, its composition is as follows :—

MgO	16·57	Magnesia.
FeO	0·95	Protoxide of iron.
MnO	traces	Protoxide of manganese.
PO^5	28·81	Phosphoric acid.
$HO+NH_4O$	54·49	Water and ammonia.
	100·82	

which shows a close agreement with the results of an analysis by Ulex, given in Dana's *Mineralogy*.

The main forms of the crystals—the largest of which are about three lines in length—are shown in Figs. 5, 6, 7, 8, and 9. They represent quite different modifications from those given in Dana's, Naumann's, and other mineralogies, though, with the exception of perhaps one, all the planes appear to have been previously observed. Crystals of a genuine hemimorphic type—so characteristic of specimens from other localities—of the form represented in Fig. 7, are not at all of frequent occurrence; the most show only, as it were, a strong tendency towards hemimorphism in the small size or imperfect development of corresponding opposite planes (generally top and bottom). Hemihedral planes are quite rare also, for amongst the great number of crystals examined, there were only a few (Figs. 8 and 9) on which the planes marked *s* are evidently of this character.

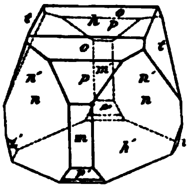

FIG. 5.

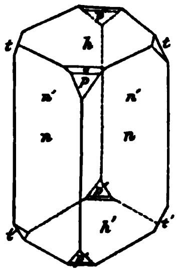

FIG. 6.

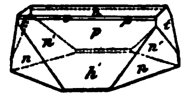

FIG. 7.

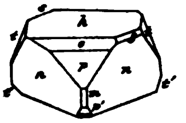

FIG. 8.

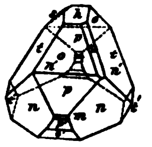

FIG. 9.

Measurements of angles around the main zones of a number of good crystals gave closely agreeing results, the mean of which is as follows:—

h : o = 137° 40′	h : t = 121° 40′ (right)	p : p over h = 58°
h : p = 119°	h : t = 121° 40′ (left)	p : m over h = 29°
h : m = 90°	t : t over h = 63° 20′	n : n = 96° 36′
o : p = 161° 20′	h′ : t′ = 121° 40′	n : n′ = 83° 24′
p : m = 151°	p : o over h = 76° 40′	n : m = 138° 12′
m : p′ = 151°		

On comparing the angles *m : n; m : p; m : h; t : t* over *h; n : n* over *m; p : p* over *h*, with those recorded for the crystal figured in Dana's *Mineralogy*, a pretty close agreement is found to exist respectively with $O : 1\breve{\imath} = 138° 25'$; $O : \frac{1}{2}\bar{\imath} = 151° 25'$; $O : i\bar{\imath} = 90°$; $i\breve{2} : i\breve{2}$ over $i\bar{\imath} = 63° 8'$; $1\breve{\imath} : 1\breve{\imath}$ over $O = 96° 50'$; $\frac{1}{2}\bar{\imath} : \frac{1}{2}\bar{\imath}$ over $i\bar{\imath} = 57° 10'$; and the planes O; $\frac{1}{2}\bar{\imath}$; $i\bar{\imath}$; $i\breve{2}$; $1\breve{\imath}$, are therefore no doubt identical with *m*, *p*, *h*, *t*, and *n* respectively. The plane I marked *o* in the figures of our Victorian crystals is absent in the crystal drawn in Dana's *Mineralogy*, though it agrees well with a plane marked *c* on a crystal figured in Naumann's *Mineralogy*: angle *c* : *c*, being there given as 95°, whilst I make angle *o* : *o* = 95° 20′. Naumann's plane *a* is no doubt also identical with Dana's $i\breve{2}$ and *t* in my figures, according to angles *a* : *a* = 63° 7′; $i\breve{2} : i\breve{2} = 63° 8'$, and *t* : *t* = 63° 20′. The hemihedral plane *s* seems to be quite new, and is, as before remarked, very rare: it was, on account of its small size and dullness, not measurable. The manner in which I have placed the crystals upright differs from that adopted in Dana's *Mineralogy*, where *m* instead of *h* is chosen as top-plane, but is, I think, justified by their different mode of development. The nearly symmetrically developed crystal represented in Fig. 6 served me as a guide, and on it plane *m*, which is generally very small, is entirely absent. With regard to the terminal and basal planes *h* and *h′*, it has to be mentioned that the former, which is invariably smaller than the other, is generally bright and even, whilst *h′* is mostly devoid of one or both these properties, and therefore seldom fit for measurement. Between the upper pyramidal planes and the corresponding ones below, I observed no marked difference, either in lustre or evenness.

Accompanying the *Struvite* there occur also in the guano white earthy nodular patches that have, according to Mr. Newbery's analysis, a similar composition as the former, except that water is absent. Whether they are the result of the decomposition of *Struvite*, or, on the contrary, represent, so to speak, the matrix from which that mineral has been formed, is left uncertain. That the *Struvite* crystals, on exposure to the atmosphere, become soon coated with a white powdery crust of decomposition, would speak for the former view.

FLUOR-SPAR.

This mineral has recently, for the first time, been found in Victoria, by Mr. Ed. Dunn, in the brecciated porphyry dyke near Beechworth, that contains, as previously mentioned, implanted grains of *tin-ore*. It occurs in small, imperfect, octahedral crystals, short narrow veins, and small patches; has a dirty amethystine color, and is mostly associated with *iron pyrites* and *chalcedonic quartz*.

SAPPHIRE, ORIENTAL RUBY.

The Rev. Dr. Bleasdale reported to the Royal Society, some time ago, that a number of grains and imperfect crystals of the true *Oriental Ruby* of fine color, and several of a size worth cutting, together with larger grains of yellow and green *Sapphire* (*Oriental Topaz*, *Oriental Emerald*), had been discovered somewhere in the neighborhood of Pakenham, near Mr. Henty's station, confirming thus my determination of small grains of the identical varieties of *Sapphire* from the same district several years ago. He kindly presented to the National Museum one of the *Rubies*—a small but nearly perfect crystal of the form given in Fig. 10 (hexagonal prism with pyramidal planes)—that from its fine violet color would by jewellers be called *Oriental Amethyst*. It resembles the *quartz-amethyst* indeed very much, but its distinction from the latter is easily proved by its more acute pyramid, far superior hardness (scratching *topaz*), and its action upon the dichroscope. It also shows before the blowpipe, on and after strong heating, a behaviour generally recorded for the *spinel ruby*, but which, by repeated trials with specimens of the *Oriental Ruby*, I found to be also characteristic of the latter, viz., that it becomes quite dark opaque, and on cooling turns first green, then colorless, and ultimately resumes its original red color.

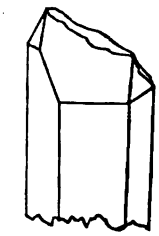

FIG. 10.

The exact place, mode of occurrence, and matrix of the gem-stones shown by Dr. Bleasdale were not for certain known at the time. A geological excursion through that district since enables us now, however, to state, with some certainty, that the *Rubies* hitherto shown came from the *locale* of the Berwick tin-mine, viz., William Wallace's Creek, that drains the ranges north of the Gippsland road, about eighteen miles north-east of the township of Berwick. And it can further be stated that there is every probability of tributaries of this creek, and perhaps independent neighboring creeks, containing the gem likewise. The main geological formation of that part of the country, and for a great extent further north and east, consists of granite, that in the rather steep ranges, bounding Wallace's Creek, is of a coarse-grained and highly porphyritic character. The crests of these ranges are, however, in parts covered by an older non—or but slightly—vesicular *dolerite*, rich in *olivine*, that bears a very close resemblance to the older doleritic basalts of Phillip Island and Western Port, with which it was probably contemporaneously erupted, and once stood in connection, and that by its decomposition and consequent production of rich marly soil gives rise to the luxuriant vegetation of those districts. Which of the two rocks, whether *granite* or *basalt*, is the matrix of the *Ruby*, could not definitely be ascertained, but certain circumstances lead to the conclusion that it is very probably the latter. The drift of Wallace's Creek is rich in nodules and pebbles of *chalcedonic varieties of quartz*, and the miners have observed that wherever colored stones (*Ruby*, *Sapphire*, &c.) occur, they are always associated with these *chalcedony* pebbles; whilst, on the other hand, none of the former are found, where the latter prove absent. These facts justify the supposition that both minerals have been derived from the same matrix, and that this is the older doleritic basalt, just spoken of, does not admit of much doubt, if we remember its close resemblance to the basalt of Phillip Island and neighborhood, and that the latter is specially rich in *chalcedony*, which occurs in regular veins, composed of disconnected nodules and geodes. The derivation of the different varieties of *Sapphire* from the basalt at Wallace's Creek would also well accord with their occurrence in the basaltic rocks of Europe—for instance, of the Auvergne, the Rhine, &c.—and also with the frequency of the common *Sapphire* in the gold-drifts of our western goldfields, especially Daylesford, Blue Mountain, Ballarat, Ballan, Loddon River, &c, where its being derived from older denuded basalts is generally considered an established fact. With regard to the origin of the fine *Sapphires* and *Rubies* found in the drifts of the extensive Beechworth goldfields, it is commonly thought that, as basalt appears to be absent, they come from the granite and other old crystalline rocks abundant in that district. This is, however, also doubtful, for Mr. Selwyn found, in his geological exploration of that part of the country, not only pebbles of dense crystalline basalt dispersed through the drifts of the goldfields, but, in addition, that most of the high ranges from which the Beechworth creeks take their rise are capped by patches of older basalt, thus proving conclusively that extensive denudation of this rock has taken place, and it may therefore here also have been the matrix of the *Sapphire*.

TOPAZ.

Of this gem-stone I have also to report two new localities of occurrence. Two very fine specimens, of light-blue color, and clear—one a rounded pebble, the other a rather water-worn crystal of the accompanying form (Fig. 11), and of 913·35 grains in weight—both now in the National Museum—were discovered by Mr. Brown's Geological Survey party in the washed pebble-heaps of the Bradford Lead, Maldon. They are both of a size and clearness to be of value to the lapidary, and the larger one is very little inferior to the celebrated blue *Topazes* found several years ago at Dunolly.

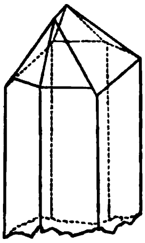

FIG. 11.

Mr. Hornsby, of Maldon, possesses a broken *quartz*-pebble, also from the above lead, that shows embedded a colorless transparen crystal of *Topaz*, about two lines in length. Though very much resembling it in appearance, it is easily distinguishable from *rock crystal* by its terminal planes, the oblong form of the prism, and the vertical striation of the prismatic planes. The second new locality for *Topaz* is the Mount Greenock Lead, near Talbot. I have seen and examined from there small rounded grains up to a pea in size, transparent, colorless, and of light-blue color. Pebbles have, however, been found larger than a walnut—unfortunately, however, too much fractured to be of any intrinsic value. An interesting novelty with regard to *Topaz* was lately communicated to me by Mr. Ed. Dunn, of Beechworth, namely, that he had been shown a rounded piece of the mineral of the size of a large bean that contained a number of small fluid cavities of various sizes, showing gas- or air-bubbles. Remembering that Sir David Brewster discovered in *Topaz* crystals from the Brazils, Scotland, and, as mentioned in Dana's *Mineralogy*, also from Australia, the two rare fluids *brewsterlinite* and *cryptolinite*, it is not at all unlikely that either of the two, or perhaps both, are represented in the specimen seen by Mr. Dunn. That the cavities and bubbles are numerously visible to the naked eye, appears also a rare occurrence, as, according to Dana, they are mostly microscopic.

GARNET.

The *precious* variety of this mineral—the *Almandine*—hitherto only known from the gold-drift of numerous creeks of the Beechworth goldfields, is reported from creeks of the mountainous country north-east of Berwick. Mr. Norman Taylor found it in the washdirt of a hole sunk at Hill's corner, near Dr. Baynton's station, at the junction of the silurian and granite, the latter overlaid by basalt. It generally appears in irregular flat dark pinkish-violet colored grains; only one small crystal—a perfect trapezohedron—was observed. He also found grains of similar color and character in the basalt of Magnet Hill—same locality.

Rounded granules of the mineral, some nearly of the size of a small pea, were discovered in specimens of a peculiar porphyritic greenstone brought by Mr. Selwyn from the base of Mount Timbertop.

For the *common Garnet* four new places of occurrence deserve special mention. The first is the Bradford Lead, Maldon, where it is found in more or less perfect crystals embedded in washed crystals and pebbles of *rock crystal* and *smoky quartz*. They were first considered to be *rubellite*, but after Mr. Hornsby, of Maldon, who discovered the mineral, sent specimens for examination to the Geological Survey Office, I identified them as *Garnets*. More specimens were obtained by the Geological Survey party under Mr. Brown's direction, amongst which was one pebble of *smoky quartz*, that yielded, on being broken, about eight small crystals. They are of no value to the lapidary, as their size only varies from that of a pin's head to that of a pea—rarely—and their color from light honey-yellow to dark-blood and brownish-red, the larger crystals being generally cloudy or quite opaque. The form of the perfect crystals is that of the rhombic-dodecahedron, modified by the planes of the common trapezohedron; but there are some crystals—generally those of yellow color — that are real crystallographic curiosities. These generally appear—on being first exposed through breaking of the matrix—as regular hexagonal tables, or rather as the basal planes of hexagonal prisms, with the horizontal edges truncated by very narrow pyramidal planes, and the basal plane itself mostly showing fine concentric striæ. On one or two crystals these striæ appear, as it were, to rise gradually from the margin towards the centre of the plane: they are in reality the edges of innumerable, extremely thin, hexagonal plates of gradually decreasing size, piled symmetrically upon each other up to a point, thus forming apparently a very low hexagonal pyramid. (Fig. 12 *a*.) It would hardly have been possible to recognize these forms as modifications of monometric crystals, had not a couple of them, on being with considerable difficulty detached from the quartz, exhibited triangular and rhombic planes on the reverse of the quasi pyramid, that enabled me to deduce the abnormal forms as resulting from the imperfect development of part of, or more commonly the halves of the crystals, *i.e.*, each is only properly developed up to a plane cutting right through the centre of the rhombic-dodecahedron, or running parallel to this centre plane, as shown in Fig. 12 *b*.

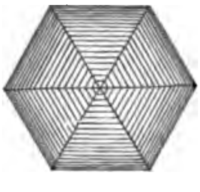

FIG. 12 *a*.

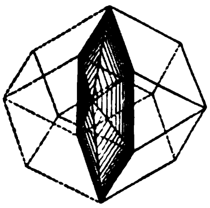

FIG. 12 *b*.

The second new locality of occurrence of the *common Garnet* is in the granite ranges near Chiltern. Mr. Brough Smyth kindly showed me some time ago one of the specimens found by the Rev. Mr. Love, of Rutherglen. This was an imperfect crystal of nearly the size of a walnut, of a deep brownish-red color, in places rather opaque and flawed, and showing the planes of the rhombic-dodecahedron and trapezohedron (truncating the edges of the former) nearly in equilibrium, similar to the *Garnets* discovered in South Australia. As specimens of this size, if clear and without flaws, would be of value to the lapidary, a closer examination of the respective locality might perhaps prove remunerative.

Quite recently Mr. Ed. Dunn, of Beechworth, presented me with a number of *Garnet* crystals, from a large pin's head to above a pea in size, found on Lady Franklyn Hill, near Chiltern. They are quite opaque, of dark greyish-brown color, and represent the common trapezohedron, some modified by narrow planes of the rhombic-dodecahedron.

The fourth new find of *Garnet*, notified to me by Mr. Ed. Dunn, was made in workings lying about two chains south of the shaft sunk on No. 3 *tin-ore* vein, near Beechworth, previously described. The mineral occurs here in rounded grains and perfect crystals, from a pin's head to that of a pea in size, which are of deep wine-yellow color and semi-transparent. The crystals represent the trapezohedron, rarely modified by planes of the rhombic-dodecahedron.

QUARTZ AND SOME OF ITS VARIETIES.

In my former description of Victorian minerals, I mentioned that near Dr. Baynton's station very fine *Quartz* crystals occurred, some nearly two inches in length, each of which showed within an envelope of *Rock crystal* a small crystal of white opaque *Quartz*. Mr. Norman Taylor, field geologist, the discoverer of the specimens, has since kindly given me the following particulars with respect to their occurrence:—On getting a hole sunk in the granite on Jew's Harp Creek, south-west of Dr. Baynton's station, a horizontal crack or elongated cavity was struck in the rock, the walls of which were lined with the crystals pointing towards each other, and the intermediate spaces being filled with a yellow clay. The crystals exhibit their mode of growth in a very marked manner, especially when polished, and some show peculiar features, indicating some disturbance during their formation. One, for instance, appears to be split at the top, and within the opening lies a smaller imperfect crystal crosswise. On several others the transparent envelope appears to have been broken down at the base, so as to permit the protrusion of the pyramidal points of the inner white opaque crystals. One of these looks as if it had been broken obliquely through the prism and re-cemented again with a slight displacement, the edges of the junction showing narrow planes of the pyramid. In most of the specimens found, the white opaque crystals appear within or very near the centre of the envelope; the remainder show them, however, quite on one side. Very fine and large *Rock crystals*, some enclosing filamentous tufts of a green mineral, probably *chlorite*, and attached to large crystals of *orthoclase*, have been found in the bed of the Coliban River, below Orr's station (Stratford Lodge). They are apparently derived from a vein in granite under the little falls of the river.

Druses of fine large *Quartz* crystals (*Rock crystal* and *Cairngorm* occasionally) occur, as mentioned, in the vein carrying *molybdenite*, *wolfram*, &c., discovered by Mr. Rule near Maldon. A great number of the crystals I examined contain enclosed acicular crystals and tufts of *schorl*, and some are modified by the more common hemihedral planes (2–2, Fig. 186, Dana's *Mineralogy*). The most interesting specimen in Mr. Rule's possession, however, is a tolerably clear crystal, about half an inch long, and nearly as broad, which exhibits inside, near the top of the pyramid, a small tuft of *schorl* needles, and above this a fluid cavity with a very lively air- or gas-bubble of nearly the size of a small pin's head.

Agate.

Two new places of occurrence of this mineral have been discovered, the one by Mr. Hardy in the surface-drift near Berwick and Dandenong, the other by Mr. Charles Wilkinson in the shingle bed at the mouth of the Gellibrand River, Cape Otway coast. The specimens from both places show banded patterns, those from the latter being nodules of 3 to 4 inches in diameter.

Flint.

It was also found by Mr. Hardy in nodular masses, several inches in diameter, in the surface-drift near Dandenong. Color, dark smoky-brown with nearly opaline lustre; nodules coated with a white earthy, silicious crust.

OPAL.

Fine nodular pieces of it have been found in the basalt near Sunbury. One specimen, in the Public Museum collection, is colored light-blue in the centre, and greenish-brown outside, showing in this outer division parts that are white, vesicular, and friable, and contain *iron pyrites.* Both the blue and brown portions become, according to Mr. Newbery's examination, opaque white on heating, and contain $\overset{\cdots}{\mathrm{Fe}}$ and $\overset{\cdots}{\mathrm{Al}}$. The brown portion contains 6·8 per cent. of $\dot{\mathrm{H}}$, and has a specific gravity of 2·049; the blue nucleus gives 8·5 per cent. $\dot{\mathrm{H}}$, and has a specific gravity of 2·038.

Another new locality for *Opal* is the basalt of an outlier at Gelantipy, Gippsland. It is there abundantly dispersed through the rock in small rounded grains, some of which, by showing some play of colors, resemble the real *precious Opal* very much.

EPIDOTE, EPIDOSITE (EPIDOTE ROCK).

This mineral has not as yet been observed well crystallized in Victoria. It occurs in the neighborhood of Talbot, on the range at the head of Nuggety Gully, in yellowish-green patches of fibrous or divergent structure, associated with *quartz* and flesh-colored *orthoclase.* This mineral mixture—in which the felspar greatly predominates—appears to form a vein traversing *syenite,* and might be called either *Epidote granite* or *Epidote syenite,* just according as the *Epidote* is considered to replace *mica* or *hornblende.*

Epidote occurs also in the rather rare form of a dense crystalline rock, associated with a patch of diorite greenstone. The locality is in the lower silurian ranges, about two and a half miles south-east of Tarilta, a little township on the Kangaroo Creek, seven miles south of Castlemaine. In several holes sunk by the Geological Survey party to determine the boundary of the greenstone, the *Epidote rock* was struck, forming apparently a zone of uncertain width between the greenstone and silurian. It consists of an intimate mixture of yellowish-green *Epidote—Pistacite*—with *quartz,* and is in places rendered porphyritic by accession of thin needles of black *hornblende* and crystals and crystalline particles of *albite.* A carefully selected sample of the dense green, non-porphyritic rock showed a specific gravity of 3·25; and two quantitative analyses, one of this, the other of a more quartzose portion, gave respectively :—

	No. 1. Dense green rock.	No. 2. More quartzose sample.
SiO_2	51·80	59·62
Al_2O_3	20·80	17·86
Fe_2O_3	15·20	5·60
CaO	12·20	14·65
MgO	traces	traces
KO	traces	traces
NaO	traces	traces
HO	—	2·48
	100·00	100·21

Of which the composition of No. 2 agrees tolerably well with that of *Epidosite* from Canada, analyzed by Sterry Hunt. A calculation to determine the amounts of *quartz* and pure *Epidote* in the rock sample, No. 1, from the respective specific gravities of the three bodies—taking *quartz* as 2·64, *Epidote* as 3·4, and the rock as 3·25—gives very nearly sixteen per cent. of *quartz* and eighty-four per cent. of *Epidote.* Deducting the former from the silica of the analysis, and calculating the remainder again to percentages, leaves SiO_2 42·6, Al_2O_3 24·8, Fe_2O_3 18·1, CaO 14·5—a composition agreeing tolerably well with that of the variety of epidote called *Pistacite.*

AUGITE.

This is rather a rare mineral in the colony, as it was hitherto known to occur but sparingly and imperfectly crystallized in two or three places. Fine solitary crystals of it. of the form shown in Fig. 13, have lately, however, been found at three new localities.

The first is at the foot of Mount Wallace, near Steiglitz, in a kind of basaltic ash, and the discovery was made by the Water Supply engineer's party, whilst sinking trial shafts. The crystals which I identified as *Augite* in a lot found by my brother are up to half an inch in size, and generally associated with crystalline pieces of *oligoclase.* The small plane *t* (see figure) appears to be very rare. The other two new localities, found by Mr. Brown's Geological Survey party, are on the slopes of Mount Hepburn and near a spring on the west side of Mount Moorokyle. The matrix of the crystals is here also a crumbly basaltic ash; they are, however, very small, generally not above an eighth of an inch in size, yet mostly perfect all round. Twin crystals and the small oblique top plane *t* appear to be pretty frequent.

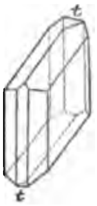

FIG. 13.

SERPENTINE, CHRYSOTILE.

Amongst a number of minerals and rock specimens collected by Mr. Selwyn on his geological excursion to Mount Timbertop are several from the flank of this mountain that closely resemble the specimens of greenish-black *Serpentine* rock I brought from the Radau Valley, Hartz Mountains, North Germany; and the result of a quantitative analysis of the rock by Mr. Cosmo Newbery has indeed proved it to be *Serpentine*, and not very different in composition, at least as regards the principal constituents, from the Hartz rock, as will be seen on comparing the two analyses:—

	Rock from Mount Timbertop.	Rock from the Radau Valley, Hartz; analyzed by Prof. Dr. Streng.[*]
S	—	trace
TiO_2	—	—
SiO_2	39·90	35·67
Al_2O_3	8·20	2·98
Fe_2O_3		6·04
Cr_2O_3	—	0·87
FeO	—	4·95
CuO	—	trace
MnO	—	0·11
CaO	—	0·18
MgO	36·80	35·03
KO NaO	—	0·77
Chromic Iron	—	1·37
PO_5	—	0·03
HO	15·40	12·04
	100·30	100·04

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[*] Bronn's and Leonhard's *Year-book for Mineralogy, Geognosy, &c.*, 1862, pages 513 to 556, and 933 to 989.

Besides color and composition, there are in addition two other interesting points of resemblance between the Mount Timbertop and Hartz *Serpentine* specimens, viz., firstly, that both are traversed by thin seams of light-yellow, silky-fibrous *Chrysotile*, a subspecies of *Serpentine*, and, secondly, that whilst the latter specimens show in places a peculiar strong semi-metallic lustre, indicative of the presence of the mineral *schiller spar*, the former exhibit this lustre also, though far less pronounced; from which we may conclude, either that *schiller spar* was once present, and is now more or less changed into *Serpentine*, or that it is perhaps just in course of formation from this rock.

DAMOURITE (?).

Two of a number of worn crystals and pebbles of *smoky quartz*, obtained from the Bradford Lead, Maldon, contain a mineral embedded that, by its color and perfect cleavability into thin transparent laminæ, greatly resembles *muscovite mica*. In one of the specimens it forms irregularly-shaped grains of a rose-red color, in the other a lenticular-shaped small mass, colored yellowish-white. Its hardness is about 2; it has a pearly lustre on the cleavage planes; fuses before the blow-pipe with extreme difficulty on the edges to a white enamel; gives a fine blue color with cobalt solution, and, what distinguishes it from *mica*, gives off water in the closed tube on heating, and the laminæ it can be split into are non-elastic. All these characters accord well with those given for *Damourite;* still a quantitative analysis (for which the material at hand does not suffice) would no doubt be desirable to conclusively establish the identity.

ALLOPHANE.

This mineral, which is quite new to Victoria, I identified in a fine specimen, kindly shown to me by Mr. Th. Couchman, Chief Mining Surveyor, who obtained it from Pleasant Creek, where it occurs in the cap of the Hampshire Reef, Golden Point. It has a fine honey-yellow color, and strong opaline lustre, with a certain iridescence playing through it in different directions, is very brittle, and has a hardness about 3. Treated before the blowpipe it gives off much water in the closed tube, falls with some intumescence to powder, and affords a fine blue color with solution of nitrate of cobalt; gelatinizes with hydrochloric acid. These reactions and its hardness prove clearly its difference from *opal*, for which it might easily be mistaken on account of its outward characters. It occurs, or rather forms kernels, in a white, rather loose sugary mineral, that shows similar reactions before the blowpipe as those just given, and may therefore be a variety of *Allophane.*

HALLOYSITE (PSEUDO STEATITE).

Substances that would come under this head have been found at several new localities. They are mainly composed of silicate of alumina, with a large percentage of water, soft, clay-like, of yellowish-white or greenish color, have a somewhat pearly or waxy lustre, a strong greasy feel, and are more or less translucent.

In the auriferous quartz veins traversing the large diorite dyke of the Morning Star Hill, Wood's Point, in the Alps Great Central Company's ground, I found a yellowish mineral of this class abundantly distributed through the *quartz* in small seams and patches. In places it was strongly impregnated with *iron* and *arsenical pyrites*, and then mostly mottled bluish-green, no doubt the result of the partial decomposition of these ores.

Thin seams and small patches of a similar mineral I found also in a yellowish soapy clay, apparently a decomposed elvan dyke, that forms the hanging wall of, and in places penetrates into, the Energetic Reef, Lauriston. Pieces of it, if placed in water, very quickly slacken, and the paste assumes a somewhat gelatinous appearance.

From one of the auriferous quartz reefs near Alexandra specimens have come under my notice, containing seams and patches that exactly resembled *saponite*, but gave before the blowpipe a fine alumina reaction. One of the specimens showed the interesting feature of several good-sized *gold* specks being enclosed within the mass of this mineral.

PYROPHYLLITE (?).

A yellowish-green, subtransparent mineral of striking *talc*-like aspect, and of same hardness, was lately forwarded to me by Mr. Ed. Dunn, who found it in the euritic granite dyke carrying veins of *tin-ore* near Beechworth. It has a foliated, in places radiated, lamellar structure, and splits into thin flexible non-elastic scales of pearly lustre. Treated before the blowpipe, it yields water in the glass tube, and in the forceps, turns pearly white, swells and exfoliates strongly, and fuses with great difficulty on the edges. With cobalt solution results a fine blue color.

According to these results, in connection with its physical properties, the mineral conforms most to *Pyrophyllite*, though it would need a quantitative analysis to remove all doubt.

PHOLERITE.

A new locality of occurrence of this mineral is, as before mentioned, the Albion Company's Reef, Steiglitz, in which it is found associated with *bournonite*, *tetrahedrite*, *gold*, &c., forming thin yellowish-white flakes and flexible laminæ in hollows of the *quartz*, and often covering crystals of it and of the two first-named minerals completely. It could not be ascertained whether it also results here, as it does at Blacksmith's Gully, Fryer's Creek, from the decomposition of *albite*.

SELWYNITE.

A description of this new mineral has already been given in the Exhibition Essay of 1867; for certain reasons it deserves, however, a further notice. It occurs in upper silurian rocks on the flank of the Mount Ida Range, about four and a half miles north-west of Heathcote, whether as a dyke or irregular mass, the explorations do not at present permit to determine; yet it very probably stands in some connection with one of the number of diorite dykes traversing that particular district. So far as is known, the mineral, when first discovered, perhaps as an outcrop, was mistaken for *copper ore* (*malachite*), and a shaft, said to be about 70 feet deep, was sunk on the spot. From the heap of stuff round this shaft, which has now fallen in, Mr. Norman Taylor, whilst geologically surveying the district, obtained a great number of specimens. These have now enabled us to thoroughly examine it and the minerals associated with it, obtain thus a better idea of their true nature, and correct some mistakes in the original description, which was founded on the examination of a few small specimens, the only ones then available.

Selwynite has, as yet, only been found massive; hardness, 3 to 4; specific gravity, 2·53; lustre, earthy, sometimes waxy; fracture, uneven and splintery; brittle. Its color ranges from siskin to dark-emerald and bluish-green, and it is sometimes minutely mottled in all these shades of green; sections of it up to a line and more in thickness are generally fine green translucent. Before the blowpipe it whitens and fuses on the edges to a greyish-white blebby glass; gives off water in the closed tube, and colors the beads of borax and microcosmic salt light-emerald green. Strong acids only partially dissolve it.

Four quantitative analyses of the mineral by Mr. Cosmo Newbery gave the following results:—

	I.	II.	III.	IV.
$\ddot{\mathrm{Si}}$	47·15	47·25	48·42	48·23
$\dddot{\mathrm{Al}}$	33·23	35·28	34·72	38·16
$\dddot{\mathrm{Cr}}$	7·61	7·82	6·94	6·14
$\dot{\mathrm{Mg}}$	4·56	2·42	2·11	1·21
$\dot{\mathrm{Na}}$	...	...	2·03	3·12
$\dot{\mathrm{H}}$	6·23	5·67	4·83	2·90
	98·78	98·44	99·05	99·76

I. Analysis of first specimen found.—II., III., IV. Recent analyses of fresh specimens, showing similar color and hardness.

According to these variations in composition, most marked as regards the protoxide bases and the water, the mineral, like others of its class, does not seem to be constituted after a fixed chemical formula, for, on calculating the oxygen ratios, we find :—

	$\ddot{\mathrm{Si}}$	$\dddot{\cancel{\mathrm{Al}}}$	$\dddot{\cancel{\mathrm{Cr}}}$	$\dot{\mathrm{Mg}}$	$\dot{\mathrm{Na}}$	$\dot{\mathrm{H}}$
I.	25·15	15·50	2·39	1·82	...	5·54
II.	25·20	16·44	2·45	0·97	...	5·04
III.	25·82	16·18	2·18	0·84	0·52	4·29
IV.	25·72	17·78	1·93	0·48	0·82	2·58

Or for,

	$\ddot{\mathrm{Si}}$	$\dddot{\cancel{\mathrm{R}}}$	$\dot{\mathrm{R}}$	$\dot{\mathrm{H}}$		$\ddot{\mathrm{Si}}$	$\dddot{\cancel{\mathrm{R}}}$	$\dot{\mathrm{R}}$	$\dot{\mathrm{H}}$
I.	25·15	17·89	1·82	5·54	or	13·82	9·83	1	3·04
II.	25·20	18·89	0·97	5·04		26·00	19·47	1	5·20
III.	25·82	18·36	1·36	4·29		19·00	13·50	1	3·15
IV.	27·72	19·71	1·30	2·58		19 70	15·16	1	2·00

which lead to very different and unsatisfactory formulæ. For instance, taking for No. I. the oxygen ratios :—

$14 : 10 : 1 : 3 = 42 : 30 : 3 : 9$, we obtain $21\,\ddot{\mathrm{Si}},\ 10\,\dddot{\cancel{\mathrm{R}}},\ 3\,\dot{\mathrm{R}},\ 9\,\dot{\mathrm{H}}$,
which may be combined either as :—

$$3\,\dot{\mathrm{R}}\,\ddot{\mathrm{Si}}^2 + 5\,\dddot{\cancel{\mathrm{R}}}^2\,\ddot{\mathrm{Si}}^3 + 9\,\dot{\mathrm{H}} = 3\,\dot{\mathrm{Mg}}\,\ddot{\mathrm{Si}}^2 + 5\left(\tfrac{7}{8}\,\dddot{\cancel{\mathrm{Al}}} + \tfrac{1}{8}\,\dddot{\cancel{\mathrm{Cr}}}\right)^2\ddot{\mathrm{Si}}^3 + 9\,\dot{\mathrm{H}};$$

or like :—

$$3\,\dot{\mathrm{R}}\,\ddot{\mathrm{Si}} + 2\,\dddot{\cancel{\mathrm{R}}}^5\,\ddot{\mathrm{Si}}^9 + 9\,\dot{\mathrm{H}} = 3\,\dot{\mathrm{Mg}}\,\ddot{\mathrm{Si}} + 2\left(\tfrac{7}{8}\,\dddot{\cancel{\mathrm{Al}}} + \tfrac{1}{8}\,\dddot{\cancel{\mathrm{Cr}}}\right)^5\ddot{\mathrm{Si}}^9 + 9\,\dot{\mathrm{H}},$$

giving the percentage ratios :—

$\ddot{\mathrm{Si}}\ 47{\cdot}83;\ \dddot{\cancel{\mathrm{Al}}}\ 34{\cdot}21;\ \dddot{\cancel{\mathrm{Cr}}}\ 7{\cdot}26;\ \dot{\mathrm{Mg}}\ 4{\cdot}55;\ \dot{\mathrm{H}}\ 6{\cdot}15 = 100{\cdot}00.$

For analysis No. III., the oxygen ratios would be : $19 : 13{\cdot}5 : 1 : 3 = 38 : 27 : 2 : 6$, giving :—

$19\,\ddot{\mathrm{Si}},\ 9\,\dddot{\cancel{\mathrm{R}}},\ 2\,\dot{\mathrm{R}},\ 6\,\dot{\mathrm{H}}$; nearest formula $\dot{\mathrm{R}}^2\,\ddot{\mathrm{Si}} + 9\,\dddot{\cancel{\mathrm{R}}}\,\ddot{\mathrm{Si}}^2 + 6\,\dot{\mathrm{H}}$; or—

$$\left(\tfrac{3}{5}\,\dot{\mathrm{Mg}} + \tfrac{2}{5}\,\dot{\mathrm{Na}}\right)^2\ddot{\mathrm{Si}} + 9\left(\tfrac{8}{9}\,\dddot{\cancel{\mathrm{Al}}} + \tfrac{1}{9}\,\dddot{\cancel{\mathrm{Cr}}}\right)\ddot{\mathrm{Si}}^2 + 6\,\dot{\mathrm{H}},$$

for which percentage ratios:—

$\ddot{\mathrm{Si}}\ 49{\cdot}08;\ \dddot{\cancel{\mathrm{Al}}}\ 35{\cdot}48;\ \dddot{\cancel{\mathrm{Cr}}}\ 6{\cdot}59;\ \dot{\mathrm{Mg}}\ 2{\cdot}07,\ \dot{\mathrm{Na}}\ 2{\cdot}13;\ \dot{\mathrm{H}}\ 4{\cdot}65 = 100{\cdot}00.$

On calculating the oxygen ratios for $\dddot{\cancel{\mathrm{R}}} = 3$, we obtain, for the four analyses:—

	$\ddot{\mathrm{Si}}$	$\dddot{\cancel{\mathrm{R}}}$	$\dot{\mathrm{R}}$	$\dot{\mathrm{H}}$		$\ddot{\mathrm{Si}}$	$\dddot{\cancel{\mathrm{R}}}$	$\dot{\mathrm{R}}$	$\dot{\mathrm{H}}$
I.	4·22	3	0·30	0·93	or	42·2	30	3·0	9·3
II.	4·00	3	0·15	0·80		40·0	30	1·5	8·0
III.	4·22	3	0·22	0·70		42·0	30	2·2	7·0
IV.	3·91	3	0·195	0·39		39·1	30	1·9	3·9

which would correspond closely to atoms of :—

	$\ddot{\mathrm{Si}}$	$\dddot{\not{\mathrm{R}}}$	$\dot{\mathrm{R}}$	$\dot{\mathrm{H}}$
I.	21	10	3	9
II.	20	10	1·5	8
III.	21	10	2	7
IV.	20	10	2	4

and allow us to construct the following formulæ :—

I.

$$3\dot{\mathrm{R}}\,\ddot{\mathrm{Si}} + 2(\dddot{\not{\mathrm{R}}}^5\,\ddot{\mathrm{Si}}^9) + 9\,\dot{\mathrm{H}} = 3\,\dot{\mathrm{Mg}}\,\ddot{\mathrm{Si}} + 2(\tfrac{7}{8}\,\dddot{\not{\mathrm{Al}}} + \tfrac{1}{8}\,\dddot{\not{\mathrm{Cr}}})^5\,\ddot{\mathrm{Si}}^9 + 9\,\dot{\mathrm{H}}.$$

II.

$$\dot{\mathrm{R}}_{\frac{3}{2}}\,\ddot{\mathrm{Si}}^8 + 2(\dddot{\not{\mathrm{R}}}^5\,\ddot{\mathrm{Si}}^9) + 8\,\dot{\mathrm{H}} = \dot{\mathrm{Mg}}_{\frac{3}{2}}\,\ddot{\mathrm{Si}}^8 + 2(\tfrac{7}{8}\,\dddot{\not{\mathrm{Al}}} + \tfrac{1}{8}\,\dddot{\not{\mathrm{Cr}}})^5\,\ddot{\mathrm{Si}}^9 + 8\,\dot{\mathrm{H}}.$$

III.

$$\dot{\mathrm{R}}^2\,\ddot{\mathrm{Si}}^3 + 2(\dddot{\not{\mathrm{R}}}^5\,\ddot{\mathrm{Si}}^9) + 7\,\dot{\mathrm{H}} = (\tfrac{3}{5}\,\dot{\mathrm{Mg}} + \tfrac{2}{5}\,\dot{\mathrm{Na}})^2\,\ddot{\mathrm{Si}}^3 + 2(\tfrac{7}{8}\,\dddot{\not{\mathrm{Al}}} + \tfrac{1}{8}\,\dddot{\not{\mathrm{Cr}}})^5\,\ddot{\mathrm{Si}}^9 + 7\,\dot{\mathrm{H}}.$$

IV.

$$2\,\dot{\mathrm{R}}\,\ddot{\mathrm{Si}} + 2(\dddot{\not{\mathrm{R}}}^5\,\ddot{\mathrm{Si}}^9) + 4\,\dot{\mathrm{H}} = 2(\tfrac{3}{8}\,\dot{\mathrm{Mg}} + \tfrac{5}{8}\,\dot{\mathrm{Na}})\,\ddot{\mathrm{Si}} + 2(\tfrac{7}{8}\,\dddot{\not{\mathrm{Al}}} + \tfrac{1}{8}\,\dddot{\not{\mathrm{Cr}}})^5\,\ddot{\mathrm{Si}}^9 + 4\,\dot{\mathrm{H}};$$

giving percentage ratios for :—

	I.	II.	III.	IV.
$\ddot{\mathrm{Si}}$ ...	47·83	48·07	48·91	48·55
$\dddot{\not{\mathrm{Al}}}$ ...	34·21	36·10	35·00	36·46
$\dddot{\not{\mathrm{Cr}}}$ ...	7·26	7·66	7·42	7·73
$\dot{\mathrm{Mg}}$ ...	4·55	2·40	1·86	1·21
$\dot{\mathrm{Na}}$ ...	...	...	1·92	3·14
$\dot{\mathrm{H}}$ ...	6·15	5·77	4·89	2·91
	100·00	100·00	100·00	100·00

NOTE.—The atomic weights used in the foregoing calculations, and throughout these notes, are those given in Dana's *Mineralogy*, fifth edition.

It will on comparison be found that these results agree pretty well with those of the four analyses, whilst the formulæ clearly represent that the silicate of the protoxides, together with the water, are the changeable constituents of the mineral. The apparently fixed constituent, the silicate of the sesquioxides, stands in a peculiarly interesting connection with another mineral, that traverses *Selwynite* in thin pearly seams, sometimes resembling silky threads, and that, from its indeed very close resemblance to *talc*, was mistaken for such, though after a recent close examination and analysis, which the original specimens did not permit, it has turned out to be quite a new mineral, and will be noticed next. The color of *Selwynite* is due to the sesquioxide of chromium, which is no doubt derived from the *chromic iron-ore*, abundant, as is well known, in the Heathcote and Mount Ida districts. In Dana's *Mineralogy*, fifth edition, 1868, the mineral is, on account of this chromiferous character, classed together with *wolchonskoite* and *chrome ochre*, in the appendix to the hydrous silicates, though with one exception—that of a chrome ochre from Halle, Germany (*vide* Analysis, page 510, Dana)—their differences in chemical composition are very great. Misled by the mistake regarding the *talc-like* mineral, and the constituent $\dot{\mathrm{Mg}}$, I was originally under the impression that *Selwynite* might be an altered chromiferous *serpentine*, and took it to be allied to *pyrosclerite*; but since the recent investigation I am inclined to regard it as perhaps an altered felspathic mineral, related to some of the species placed by Dana under the *Pinite* group; for instance, to *gieseckite* and *dysyntribite*. For the sake of easy comparison, I give here the results of the analyses by Stromeyer and Pfaff of the former mineral, as stated in Dana's *Mineralogy*, page 481, and of the latter by Shepard, *American Journal of Science*, II., se. XII., page 209; also that of No. III. Analysis of *Selwynite* by Newbery :—

	$\ddot{\mathrm{Si}}$	$\overset{\cdots}{\cancel{\mathrm{Al}}}$	$\overset{\cdots}{\cancel{\mathrm{Fe}}}$	$\overset{\cdots}{\cancel{\mathrm{Cr}}}$	$\dot{\mathrm{Mn}}$	$\dot{\mathrm{Fe}}$	$\dot{\mathrm{Mg}}$	$\dot{\mathrm{Na}}$	$\dot{\mathrm{K}}$	$\dot{\mathrm{H}}$	
Gieseckite—*Stromeyer* ...	46·08	33·83	3·36	...	1·15	...	1·20	...	6·20	4·89	= 96·71
Ditto—*Pfaff*	48·00	32·50	4·00	...	...	...	1·50	...	6·50	5·50	= 98·00
Dysyntribite—*Shepard* ...	47·68	41·50	...	...	...	5·48	...	...	...	4·83	= 99·49
Selwynite, No. III. Analysis —*Newbery*	48·42	34·72	...	6·94	...	...	2·11	2·03	...	4·83	= 99·05

These analyses show, that besides its containing a somewhat smaller amount of different protoxide silicate, the main specific character distinguishing *Selwynite* from the other minerals is only the presence in it, as an isomorphous substitute for alumina, of the sesquioxide of chromium, to which it owes its fine shades of green color. In a practical point of view it may likely, on account of this color, become of some value to the jeweller and lapidary; for instance, as a substitute for the small ornaments of New Zealand *nephrite*, which are at present very fashionable. It takes a very fair polish, but has unfortunately a tendency to crack along numerous fine joints, traversing larger pieces, thus rendering the cutting of ornaments beyond one inch in size rather difficult. Still, there is a probability that this unfavorable property, attaching to pieces taken from the surface of a heap of stuff for many years exposed to atmospheric influence, may be altogether absent in the mineral when freshly broken from the mass underground.

TALCOSITE.

A new mineral species. It occurs, as just mentioned, in thin, shining, transversely minutely laminated seams and threads in the *selwynite* of Heathcote, being in appearance, hardness, and feel so exactly like *talc*, that it was at first mistaken for it. Hardness, 1, in the line of lamination; 1·5 to 2·0 at right-angles against it; specific gravity, 2·46 to 2·5; color, silver-white, with sometimes a faint greenish or yellowish tint; high pearly lustre; laminæ or scales generally very small, translucent, and slightly flexible—not elastic. No distinct crystals observed as yet; they appear, however, to be rhombic plates, according to some specimens on which the exposed broad surfaces of seams show an irregularly oblique network of scaly crystals of apparently rhombic character. These surfaces bear some resemblance to the drusy aggregations, with upright edges of small obtuse rhombohedrons, in which *calcite* and *brown spar* are often met with. Treated before the blowpipe, it gives off water in the closed tube; becomes white opaque, and exfoliates in the forceps, and, after some blowing, fuses at 4 to a white blebby enamel; fine blue color with cobalt solution.

Two quantitative analyses by Mr. Cosmo Newbery gave the following results:—

	$\ddot{\mathrm{Si}}$	$\overset{\cdots}{\cancel{\mathrm{Al}}}$	$\overset{\cdots}{\cancel{\mathrm{Cr}}}$	$\dot{\mathrm{Fe}}$	$\dot{\mathrm{Mg}}$	$\dot{\mathrm{Na}}$	$\dot{\mathrm{H}}$		
I.	49·01	45·1	trace	trace	trace	...	4·98	=	99·09
II.	49·07	46·96	,,	,,	,,	trace	3·73	=	99·76

The oxygen ratios for silica, alumina, and water result as follows:—

		$\ddot{\mathrm{Si}}$	$\dddot{\mathrm{Al}}$	$\dot{\mathrm{H}}$
	I.	26·14	21·02	4·43
	II.	26·17	21·88	3·34
Or,	I.	3·73	3·00	0·63
	II.	3·45	3·00	0·46
Or,	I.	18·65	15·00	3·15
	II.	17·25	15·00	2·30

of which the mean would closely conform to:—

$$9\,\ddot{\mathrm{Si}};\ 5\,\dddot{\mathrm{Al}};\ 3\,\dot{\mathrm{H}} = \underline{\dddot{\mathrm{Al}}^{5}\,\ddot{\mathrm{Si}}^{9} + 3\,\dot{\mathrm{H}}}$$

with the calculated percentage composition of:—

$\ddot{\mathrm{Si}}$	$\dddot{\mathrm{Al}}$	$\dot{\mathrm{H}}$		
48·70	46·43	4·87	=	100·00

A comparison of this formula with that found for *selwynite*, for instance of No. III. analysis, viz.:—

$$\dot{\mathrm{R}}^{2}\,\ddot{\mathrm{Si}}^{3} + 2\,(\dddot{\mathrm{R}}^{5}\,\ddot{\mathrm{Si}}^{9}) + 7\,\dot{\mathrm{H}}$$

shows a remarkable coincidence in the ratios of the sesquioxide and silica; in fact, it would appear as if *Talcosite* had been formed out of *selwynite* by removal or dissolving away, in the line of its seams, of all the protoxide silicate, half of that of the sesquioxide, including all the chromic oxide, and some of the water; or as if it had, as it were, crystallized out of the *selwynite*, leaving the respective constituents behind. A great difficulty experienced in its decomposition speaks, however, somewhat against this latter view.

As in none of the Mineralogies consulted a mineral can be found similarly constituted, it must therefore be regarded as a new species, and it is proposed to call it *Talcosite*, on account of its close resemblance to *talc*. In its physical properties, and the quantity of water it contains, it is no doubt closely allied to *pyrophyllite*, but differs from it too considerably in the percentages of silica and alumina as to be considered identical. On the other hand, it also has some resemblance to several of the varieties of *kaolinite* (described in Dana's *Mineralogy*, fifth edition) both in outward character and in approaching them in its contained silica and alumina; however, we meet here again the material distinction of the *kaolinites* containing nearly three times as much water. Dana's comparison of *pinite* to an *alkali-alumina serpentine* and *pyrophyllite* to an *alumina talc*, would no doubt be applicable also to *selwynite* and *Talcosite*, with this difference, that the former may be more strictly designated as a *chrome-alumina serpentine*.

FIBROLITE.

Mr. Ed. Dunn, of Beechworth, presented me lately with a number of specimens, collected in the granitic neighborhood of that town, amongst which I recognized three pieces of the mineral *Fibrolite*, which has hitherto only been known to occur in the granite of the Moroka Valley, Gippsland. It is of fibrous massive structure, greyish-white and hair-brown color, and bears great resemblance to *tremolite* or *asbestiform hornblende*, for which indeed it might very easily be mistaken. Its perfect infusibility before the blowpipe, and the fine blue color it gives with solution of cobalt, shows, however, the distinction. A qualitative analysis by Mr. Newbery showed only alumina and silica, and a doubtful trace of magnesia.

ANALCIME.

This zeolite was hitherto only known to occur very finely crystallized in the older basalt of Phillip Island. It has recently, however, been also found in the basalt of Chambers's quarry, Richmond, associated with *herschelite* and *phillipsite*. The crystals are, however, very small—the largest scarcely a line in diameter—and form dense aggregations, or regular drusy coatings on some of the specimens, and being of yellowish-white color and nearly transparent, appear generally quite black on account of the dark basaltic back-ground shining through them. Their form is the common trapezohedron, not modified, as far as I could observe, by any other planes.

SCOLECITE.

I identified this zeolite for the first time in thin drusy coatings of very minute crystals on decomposing granite from O'Keefe's shaft, Preston Vale (Coliban water supply contract). The small size of the crystals allows nothing beyond recognizing them as prismatic, with pyramidal planes. The strong curling up of the mineral before the blowpipe and the large amount of lime it contains, as indicated by a qualitative analysis by Mr. Newbery, leave no doubt, however, of its being *Scolecite*. Its origin is most likely, in some measure, due to the decomposition of the *oligoclase felspar*, which is very abundant in the granite of the just-mentioned locality.

I also recognized *Scolecite* lately by its reaction before the blowpipe, and in the moist way on some specimens of a dense greenstone from the neighborhood of Yackandandah, sent to me by Mr. Ed. Dunn. It occurs in joints and cracks of the greenstone in thin, white coatings with radiated structure somewhat resembling *wavellite*.

MESOLITE.

A zeolite likewise new to Victoria. It occurs in sphæroidal nobs, and rarely stalactitic forms, in hollows of the very vesicular basalt from the shaft of the Ballarat and Clunes Mining Company, Clunes. The nobs are of a pale-blue color, semi-translucent, and have a weak pearly lustre, closely resembling some mammillated chalcedony. On account of this appearance the miners call it *pearl-stone*. The internal structure of the nobs is minutely radiated, and the fracture shows also pearly lustre. The stalactitic forms are generally white opaque, but in fracture similar to the sphærules. Before the blowpipe the mineral swells and curls—not quite as strongly as *scolecite*—and fuses ultimately to a white blebby glass. It is associated with *herschelite*, *chabasite*, and *calcite*.

HERSCHELITE.

After the first discovery by Mr. Wilkinson (of the former Geological Survey) of this interesting and rare zeolite—several years ago—in an old basalt quarry near the River Yarra at Richmond, only a few inferior specimens were obtained from this place, owing to the flooding of the quarry by the river and its consequent abandonment since. Last year Mr. Ed. Pittman, assistant in the Geological Survey laboratory, found, however, in Chambers's large quarries, adjoining the old quarry, not only specimens of the old type of *Herschelite* crystals, described by me in the Exhibition Essays of 1867, page 61, and for the sake of comparison respresented in Fig. 14, but also, associated with *phillipsite*, *analcime*, and *calcite*, very fine crystals—a number nearly perfect all round—showing modifications of planes not recorded in the principal works on mineralogy. The most interesting of these is shown in Figs. 16 *a* and *b*. It consists of a rather obtuse hexagonal pyramid *r* with replacement of the lateral corners by planes *p* of a second, acute, hexagonal pyramid, and it will be seen, on comparing it with Fig. 14 of the old type crystal, that the perfect pyramid *r* is indicated on the latter by small triangular planes, which in Fig. 15 (another form from the new place) have grown to a size, as to be, as it were, in equilibrium with the acute pyramid *p* and terminal plane *o*. About the identity of the respective planes on the three forms there can be no doubt, as proved by a number of measurements, and it must be remarked that the pyramidal planes *r* have never been observed except in combination with the particular pyramid *p*. They are generally bright

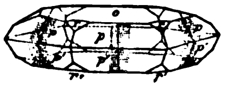

FIG. 14.

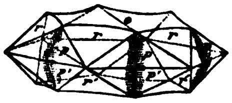

FIG. 15.

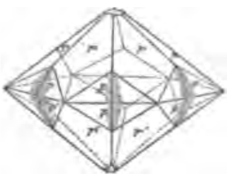

FIG. 16 *a*.

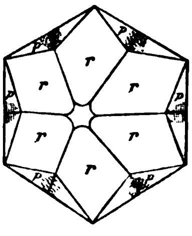

FIG. 16 *b*.

and even below, but become dull, and their terminal edges appear rounded off towards the apex, that has as yet but very rarely been seen perfect on any specimen found. The planes *p* show a very flat re-entering angle (as noticed of those of the old type crystal), have a bright, glassy lustre, but are extremely uneven, and therefore very difficult to measure with any degree of accuracy. The following angles have been obtained as the mean of a number of tolerably well-agreeing measurements of different crystals :—$p : p' = 134° 10'$; $r : r = 145°$, $r : r' = 73° 51'$ ($73° 56' 32''$ calculated on taking $r : r = 145°$ correct as the better angle). Neither the first nor last angle agrees with that given by Dr. Victor von Lang in his mineralogical notes (*Phil. Magazine*, series 4, vol. 28, page 506) of apparently analogous planes, $502 : 50\bar{2} = 50° 30'$ (compt.), Fig. 1, Plate VII., of a crystal of ***Herschelite*** from Richmond, of one of the first specimens found by Mr. Wilkinson, and presented by Mr. Selwyn to the British Museum. The learned doctor makes also no mention whatever of the indication of the second pyramid *r*, nor of the flat re-entering angle of planes *p*, both which characteristics I have never seen absent on this type of crystal, and it is therefore quite evident to me that he measured a very rare form, of which no specimens have come under my notice. The crystals of form Fig. 16 are generally quite transparent, rarely white opaque, and sit seldom on the hard basalt, but mostly on a thin layer of brown or greenish-black, soapy clay, that lines the cavities of the rock—a circumstance which makes specimens difficult to preserve, on account of the cracking of the clay on exposure to the atmosphere. They appear in irregular drusy aggregations, rarely singly grown up (Mr. Pittman presented, besides smaller ones, one specimen to the Public Museum, nearly 6 inches square covered all over with fine transparent crystals), but show no tendency to the pretty, rosette-like grouping (Fig. 17) of the crystals of the old type. Of these latter, Mr. Pittman found some white opaque ones of nearly ¾ inch in diameter, also some smaller transparent ones, grown irregularly round a thin vein of dark, hardened clay. Some of these strings of crystals are above 1 inch in length, and fine single crystals, perfect all round, could be obtained from them by careful detachment.

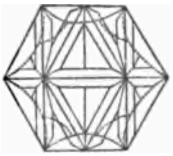

FIG. 17.

The rarest new forms of the mineral were found by Mr. Norman Taylor, and are represented in Figs. 18 and 19. In Fig. 18 the planes of the very acute pyramid are deeply striated horizontally, and therefore not fit for measurement. The whole aspect of the crystals is very near that of hexagonal prisms; some have the central horizontal edge quite obliterated, and appear thus barrel-shaped, similar to those of *pyromorphite*.—Fig. 19 : Perfect hexagonal tables, the prismatic planes strongly striated horizontally, and the basal edges replaced by pyramidal planes, too narrow and uneven for measurement. This form is very similar to one from Aci Reale, Sicily, shown in Fig. 3, Plate VII., of Dr. Victor von Lang's mineralogical notes, above referred to. The specimen found by Mr. Taylor does not, however, present single crystals, but always two and two grown together with the basal planes, as Fig. 19 shows.

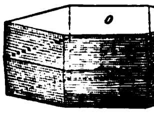

FIG. 18.

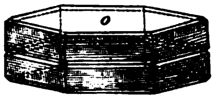

FIG. 19.

It was formerly supposed that ***Herschelite*** belonged to the rhombohedral system, and, like *levyne* and *gmelinite*, was compounded of several rhombohedrons. Dr. Victor von Lang proved, however, by optical investigation that the simple crystal of ***Herschelite***, yet unknown, must belong to the orthorhombic system, and that six are twinned together in the usual compound forms. Touching this latter deduction, I have to record some observations on a series of crystals which—not being proficient enough in crystallography—I have some diffidence in believing, might, if seen by the learned doctor, cause him, perhaps, to modify his opinion, at least for certain cases. Whilst examining the great number of fine specimens of *Herschelite* found by Mr. Pittman, I noticed that the always—more or less—rounded top planes of some of the crystals had a frosted or roughish-glistening appearance, and on examining one under the microscope found that this was not due to a crystalline coating of smaller crystals, as I at first supposed, but to countless minute triangular points or corners rising out of the mass of the crystal. On following this discovery up further, I was, on a number of different crystals, able to trace a regular gradation in the size of the points—on the one hand, to their being so minute as to be hardly perceptible under the ¼-inch objective of the microscope, presenting to the naked eye the usual dull, to all appearance smooth top plane—on the other hand, I found, however, crystals with upstanding points, nearly one-third line in size, some quite sharp (Fig. 20), but others with shining, partly triangular, partly trapezoidal curved planes truncating the sharp points (Figs. 21 and 22), producing a mixed dull and bright aspect of the top plane in reflected light (Fig. 23). In addition to, or rather as a consequence of this, the basal edges prove in side view to be acutely serrated, and whilst the common flat re-entering angles that lie generally in the centres of the pyramidal planes, communicate with one of these sharp indentations (of the basal edges), the terminal pyramidal edges of all the crystals examined merge into acute indented angles towards the basal plane. Fig. 24 represents this aspect of a crystal. Figs. 25 *a* and *b*, and 26 *a* and *b*, show the appearance of the small crystal points lying along the basal edges; *p* being part of the pyramidal plane of the large compound crystal. On reviewing all the facts in connection with this peculiar structure of the common type of *Herschelite* crystal, might it not be concluded, that the latter is symmetrically built up—not of six—but of a variable, indefinite number of micro-crystals? Any expert crystallographer examining the specimens could, I am convinced, not come to another result.

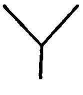
FIG. 20.

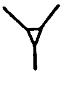
FIG. 21.

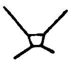
FIG. 22.

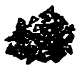
FIG. 23.

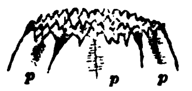

FIG. 24.

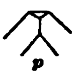

FIG. 25 *a*.

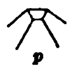

FIG. 25 *b*.

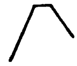
FIG. 26 *a*.

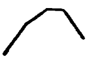
FIG. 26 *b*.

On one specimen I found also a number of crystals which showed globular, *quite bright* (appearing like glazed), though uneven and minutely broken top planes, in combination with planes of both pyramids *p* and *r*, the former without any trace of an indented angle, the latter rather imperfect, being deeply striated, with a flat indented angle in the line, where the striæ meet, *see* Fig. 27. Accompanying these crystals I noticed crystals of what appeared to me *phillipsite*, of quite the same color as the former, and it struck me, from their peculiar mode of aggregation and the strong striation of the pyramidal planes, which appeared to meet at a more obtuse angle than usual—that twelve of them twinned together—with their terminal points rounded off, and their prismatic planes meeting at angles of 134°, to form pyramid *p*, would constitute the crystal depicted in Fig. 27. However, the possibility or otherwise of this combination must be left to crystallographers to determine: if possible for these crystals, it certainly does not suit the structure of those previously described; for the micro-crystals, composing them, have not the slightest resemblance to those of *phillipsite*. A strong obstacle in all cases, besides, would be the difference in the chemical compositions of the two minerals, as given further on.*

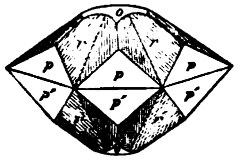

FIG. 27.

With regard to the cleavage of *Herschelite*, which is stated to be basal, I was not able to observe it on any of the specimens examined, nor on a number of crystals broken intentionally for the purpose of finding it: nothing but conchoidal fracture was the result of the operation.

In order to see how far the chemical composition of the Richmond *Herschelite* agreed with that of the mineral from other places, Mr. Edwd. Pittman made with special care, under the direction of Mr. C. Newbery, three quantitative analyses, that gave the following results :—

---

* Since the above was written, Mr. Rule found in Chambers's quarry specimens which show what certainly appear very much like *single crystals* of Herschelite, and their combinations, to forms like Figs. 16*a* and 27—some with perfect terminal points. These single crystals, which are very small, strongly resemble *rhombohedrons*, more or less modified, and with mostly diagonally broken, strongly striated and curved planes, similar to Figs. 14 and 15 of chabasite from Malmsbury, given in the Exhibition Essay of 1867.

	SiO_2	Al_2O_3	CaO	KO	NaO	HO	
I. Large opaque crystals ...	45·33	22·22	7·11	0·97	5·54	18·67	= 99·84
II. Transparent, tabular crystals with frosted tops ...	46·05	22·07	7·06	0·72	5·48	19·25	= 100·63
III. Double hexagonal pyramids, partly transparent ...	46·26	23·04	7·02	0·09	5·96	18·52	= 100·89

On comparing these compositions with one of those given in Dana's *Mineralogy* for *Herschelite* from Aci Castello, Sicily, for instance:—

$\ddot{\text{Si}}$	$\dddot{\text{Al}}$	$\dot{\text{Ca}}$	$\dot{\text{Na}}$	$\dot{\text{K}}$	$\dot{\text{H}}$		
47·39	20·90	0·38	8·33	4·39	17·84	=	99·23

a marked difference will be found, especially as regards the protoxide bases; *lime* and soda occupying in our mineral the place of *potash* and soda in that from Sicily.

A calculation of the oxygen ratios of the different components results for the three analyses as follows :—

	$\ddot{\text{Si}}$	$\dddot{\text{Al}}$	$\dot{\text{Ca}}$	$\dot{\text{Na}}$	$\dot{\text{K}}$	$\dot{\text{H}}$
I.	24·17	10·35	2·03	1·43	0·16	16·61
II.	24·56	10·28	2·02	1·41	0·12	17·11
III.	24·67	10·74	2·01	1·54	0·02	16·46

Or, for

	$\ddot{\text{Si}}$	$\dddot{\text{R}}$	$\dot{\text{R}}$	$\dot{\text{H}}$			$\ddot{\text{Si}}$	$\dddot{\text{R}}$	$\dot{\text{R}}$	$\dot{\text{H}}$	
I.	24 17	10·35	3·62	16·60	Or	I.	6 99	3	1·05	4·81	=7 : 3 : 1 : 5
II.	24·56	10·28	3·55	17·11		II.	7·17	3	1·04	4·99	
III.	24·67	10·74	3·57	16·46		III.	6·89	3	1·00	4·69	

Corresponding to $3\frac{1}{2}\ \ddot{\text{Si}},\ \dddot{\text{Al}},\ \left(\begin{matrix}\frac{4}{7}\ \dot{\text{Ca}}\\ +\\ \frac{3}{7}\ \dot{\text{Na}}\end{matrix}\right),\ 5\ \dot{\text{H}}$; or $\left(\begin{matrix}\dot{\text{Ca}}\ \frac{4}{7}\\ \dot{\text{Na}}\ \frac{3}{7}\end{matrix}\right)^{2}\ddot{\text{Si}}^{3} + 2\ \dddot{\text{Al}}\ddot{\text{Si}}^{2} + 10\ \dot{\text{H}}$

giving 45·5 $\ddot{\text{Si}}$, 22·31 $\dddot{\text{Al}}$, 6·93 $\dot{\text{Ca}}$, 5·76 $\dot{\text{Na}}$, 19·5 $\dot{\text{H}}$ = 100. The oxygen ratio of $\dot{\text{R}}$, $\dddot{\text{R}}$, $\ddot{\text{Si}}$, $\dot{\text{H}}$ of the Sicilian *Herschelite* is given as 8 : 3 : 1 : 5, and it seems, therefore, that our mineral is in this respect more closely allied to the *phacolite* from Leippa, Bohemia, analyzed by Rammelsberg, which has likewise the ratio of 7 : 3 : 1 : 5, but contains nearly four times as much lime as alkalies.

I have now to record another discovery of *Herschelite*, made last year by Mr. Brown's Geological Survey party, in the vesicular basalt from the shaft of the Ballarat and Clunes Gold Mining Company, Clunes. The mineral is here associated with *calcite*, *chabasite*, and sometimes *mesolite*, and occurs in two modifications :—1. In very thin hexagonal plates, with the basal edges replaced by very uneven planes of a hexagonal pyramid, similar to *p*, Fig. 14, of the Richmond *Herschelite*, but apparently more obtuse, and without any indication of a second pyramid. 2. In double hexagonal pyramids, quite similar to the Richmond crystals (Figs. 16 *a* and *b*). I observed one small nearly perfect double crystal of the form represented in Fig. 28, in which the small planes *n* of a hexagonal prism, truncating the lateral edges of pyramid *r*, are quite new.[*] The terminal planes of the first modification are dull and

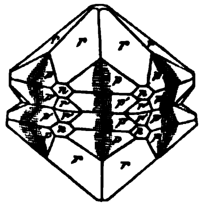

Fig. 28.

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[*] They have also been observed on crystals quite recently found at Richmond.

roughish; the terminal points of the second one imperfect, and the pyramidal planes *p* show a flat re-entering angle, all as mentioned of the Richmond crystals; a tendency to a rosette-like grouping, as the latter show, is, however, entirely absent.

PHILLIPSITE.

Of this rather rare zeolite, I discovered, about two years ago, several good specimens in the heap of vesicular basalt from the deep prospecting shaft, sunk close to Degraves' mill, near Kyneton. It occurs in opaque white crystals, up to 3 lines in size, in cavities of the rock, and is generally associated with fine, nearly transparent crystals of *chabasite*. The characteristic cruciform shape of the crystals is very plain, and exactly resembles the common form of *harmatome* from St. Andreasberg. A qualitative analysis by Mr. Newbery proved, however, the entire absence of *baryta*, and presence, in some quantity, of *lime* instead, the chief point of distinction of *Phillipsite* from *harmatome*.

A second discovery of the mineral was made last year by Mr. Edw. Pittman, in Chambers's basalt quarries at Richmond. It is found there in druses and small aggregations of opaque-white, bluish-white, and faintly transparent, and, though more rarely, of quite colorless, nearly limpid crystals, from 1 to 3 lines in size, associated with *herschelite*, *analcime*, and *calcite*. The cross-form of the compound crystals is far less apparent than on the specimens from Kyneton, the re-entering angles of the prisms being, indeed, very small. The crystals look, in fact, to the naked eye, like tetragonal octahedrons in combination with prismatic planes, not unlike some *apophyllite* (Fig. 29), and only the peculiar striation of the pyramidal planes, which I observed on different specimens, as shown in Figs. 29–32, indicates their compound nature, and the manner of twinning. Of not at all uncommon occurrence are very pretty double crosses of the form Fig. 30, a combination of three twinned crystals, perfect at both ends, penetrating each other at right-angles.

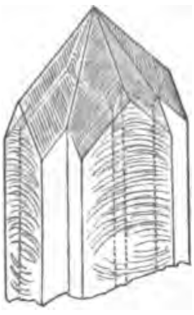

FIG. 29.

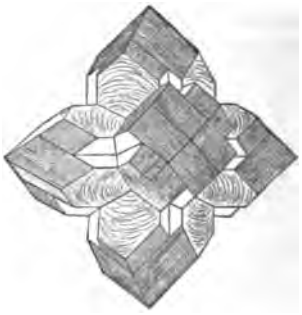

FIG. 30.

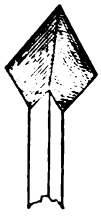

FIG. 31.

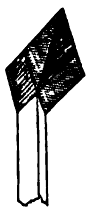

FIG. 32.

The chemical composition of this *Phillipsite* is, according to a quantitative analysis by Mr. Edw. Pittman, as follows:—

$$\begin{array}{cccccccc} \ddot{\mathrm{Si}} & \dddot{\mathrm{Al}} & \dot{\mathrm{Ca}} & \dot{\mathrm{K}} & \dot{\mathrm{Na}} & \dot{\mathrm{H}} & & \\ 46{\cdot}62 & 23{\cdot}60 & 4{\cdot}48 & 6{\cdot}39 & 5{\cdot}10 & 14{\cdot}76 & = & 100{\cdot}95 \end{array}$$

A comparison of this analysis with those of *Phillipsite* from European localities shows a considerable difference in the percentages of all components, with the exception of alumina; the large amount of *soda* contained in our mineral being especially striking.

The oxygen ratios for the different components I find as follows:—

$$\ddot{\mathrm{S}} \quad \dddot{\mathrm{Al}} \quad \dot{\mathrm{Ca}} \quad \dot{\mathrm{K}} \quad \dot{\mathrm{Na}} \quad \dot{\mathrm{H}} \qquad \ddot{\mathrm{Si}} \quad \dddot{\mathrm{R}} \quad \dot{\mathrm{R}} \quad \dot{\mathrm{H}}$$

$$24{\cdot}86 \quad 11{\cdot}00 \quad \underbrace{1{\cdot}28 \quad 1{\cdot}09 \quad 1{\cdot}32}_{3{\cdot}69} \quad 13{\cdot}12;\ \text{or for}\ 6{\cdot}78 \quad 3 \quad 1 \quad 3{\cdot}58;$$

which, as regards $\ddot{\mathrm{Si}}$ and $\dot{\mathrm{H}}$, is certainly not very satisfactory. The best course under the circumstances would perhaps be to take $7 : 3 : 1 : 3\frac{1}{2}$ as the ratios, which would give $3\frac{1}{2}\,\ddot{\mathrm{Si}}$, $\dddot{\cancel{\mathrm{R}}}$, $\dot{\mathrm{R}}$, $3\frac{1}{2}\,\dot{\mathrm{H}}$, and lead to the formula :—

$$\dot{\mathrm{R}}_2\ \ddot{\mathrm{Si}}_3 + 2\dddot{\cancel{\mathrm{R}}}\ \ddot{\mathrm{Si}}_2 + 7\dot{\mathrm{H}};$$

Or, approximately, $\begin{pmatrix} \frac{1}{3}\,\dot{\mathrm{Ca}} \\ \frac{1}{3}\,\dot{\mathrm{K}} \\ \frac{1}{3}\,\dot{\mathrm{Na}} \end{pmatrix}^{2} \ddot{\mathrm{Si}}^{3} + 2\,\dddot{\cancel{\mathrm{Al}}}\ \ddot{\mathrm{Si}}^{2} + 7\,\dot{\mathrm{H}}$,

with the following percentages:—

$\ddot{\mathrm{Si}}$	$\dddot{\cancel{\mathrm{Al}}}$	$\dot{\mathrm{Ca}}$	$\dot{\mathrm{K}}$	$\dot{\mathrm{Na}}$	$\dot{\mathrm{H}}$	
47·01	23·06	4·18	7·03	4·62	14·10	100·00.

HEULANDITE.

Mr. Rule found this *zeolite* lately in quartz from the Tiverton Reef, Maldon. It occurs in joints of the quartz in the same manner as it does at Lisle's and Lennox's Reefs, Mount Tarrangower (the only other two places known), viz., in thin drusy coatings of very small, semi-transparent, nearly colorless crystals of the form figured in my former description.

All the specimens kindly shown me by Mr. Rule exhibit thin tabular crystals of *heavy spar* grown upon the drusy coatings of this zeolite—a no doubt rare association.

HEAVY SPAR (SULPHATE OF BARYTA).

A new (the second) locality of occurrence of this mineral discovered by Mr. Rule is, as just mentioned, the Tiverton Reef, Maldon. Solitary, thin, blade-like crystals, up to $\frac{1}{4}$ inch in length, and $\frac{1}{8}$ inch broad, or aggregations of a number of such thin blades, lie flat upon a drusy coating of *heulandite* covering *quartz*. The crystals are mostly quite colorless, transparent, and perfectly developed all round, the most modified form being that shown in Fig. 33. A spectrum analysis, kindly conducted by Mr. Ellery, showed but a very faint trace of strontia.

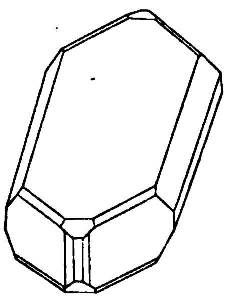

FIG. 33.

SELENITE, GYPSUM (SULPHATE OF LIME).

To the numerous localities given for this mineral in my former description may be added Schnapper Point, where it occurs frequently in thin seams, and in rather imperfect solitary crystals, some above 6 inches in length, and 1 inch thick, in the blue tertiary clay along the coast. It has also been observed in lenticular crystals and drusy coatings in the stiff bluish surface clay of Spring Plains. (Geological Survey $\frac{1}{4}$-sheet, 13 N.E.)

MIRABILITE, GLAUBER SALT (SULPHATE OF SODA).

This salt occurs, according to Mr. Norman Taylor, in fine acicular efflorescences and powdery crusts on the walls of the prospectors tunnel at Barfold or Mitchell's diggings. (Geological Survey $\frac{1}{4}$-sheet, 13 S.E.) The tunnel is driven in a white, soft, fine-grained sandstone.

BROWN SPAR.

At a recent visit to Wood's Point I recognized finely crystallized specimens of this mineral in the collection of Mr. Bailey, manager of the South Morning Star Hill Company. It occurs associated with *rock crystal* and sometimes *iron pyrites* in fine druses, lining hollows and cracks of the auriferous quartz veins traversing the massive, more or less decomposed, diorite dyke of the Morning Star Hill. Its origin is therefore no doubt mainly due to the decomposition of the *hornblendic* component of the diorite, whilst from that of the *felspathic* one (*oligoclase*) resulted a white clayey mineral (*kaolinite*) composed of fine pearly scales, that generally fills the druse cavities of the reefs, covering the other minerals. The crystals of the *Brown Spar* are from ⅛ to ¼ inch in diameter, of yellowish-white color, subtransparent, and present all the same form, viz., the obtuse cleavage rhombohedron, the planes quite even and showing a faint pearly lustre, in combination with the terminal plane, which is generally large, and always dull and uneven. Before the blowpipe pieces of the mineral strongly decrepitate, the powder turns brownish-black, but does not become magnetic—a proof of there being but little iron present. It is hardly touched by cold acids, but dissolves quickly with strong effervescence in hot muriatic acid, the solution reacting strongly for *lime* and *magnesia*.

Specimens of cellular quartz with vein-like aggregations of *Brown Spar* in yellowish-brown saddle-shaped rhombohedrons, planes quite dull and rough, have been recently found by Mr. Ferd. Kayser in the New Chum Reef, Sandhurst.

DOLOMITE (MAGNESIAN LIMESTONE).

Under this designation would, according to a quantitative analysis by Mr. Cosmo Newbery, properly come a band of very hard, so-called "*cherty limestone*" that occurs with brown *hæmatite* and *quartzite* underneath the basalt, east of Broadmeadows, on the Moonee Ponds Creek. The analysis shows its composition to be as follows :—

$\dot{Ca}\,\ddot{C}$	54·974
$\dot{Mg}\,\ddot{C}$	39·007
$\overset{\cdots}{\cancel{Fe}}$	1·476
$\ddot{Si}$ Clay, &c.	4·467
	99·924

Trials were at one time made to burn this stone for building material, but gave no favorable results. In the bed of the creek, below the outcrop of the band, occurs a thin deposit of a similar hard rock that encloses *truncatella*, and is most likely derived from the former.

CALCITE.

The rarity of this mineral throughout Victoria generally, and more particularly in the auriferous lodes of the goldfields, renders it perhaps of some interest to notice that in Campbell's Reef, Moyston (Ararat Mining District), it occurs in strong, irregular veins and patches, sometimes impregnated with specks of *galena* and crystals of *iron pyrites* (generally cubes and pentagonal dodecahedrons). *Gold* has, however, not as yet been seen in this manner,* nor have crystallized specimens of the *Calcite* come under my notice. *Calcite* is also occasionally found in thin opaque-white veins in the quartz reefs traversing the dyke of the Morning Star Hill and that of the Rose, Thistle, and Shamrock Company's lease, Wood's Point.

In the basaltic lavas it is not by far so abundant as *arragonite*. To the localities of occurrence mentioned in the Exhibition Essay of 1867 we can, however, add the basalts of Richmond and Clunes, in which generally light honey-yellow, small, acute rhombohedrons—at the former place often aggregated to club-like shapes—are found associated with the rare species of *zeolites* previously described.

Another new locality for *Calcite*, in veins from 1 to 2 feet thick, is in the carbonaceous rocks along their junction with the older basalt, at the Moe Swamp, about six miles S.E. of Westbury.

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* It may here not be out of place to remark that most of the rich quartz reefs of Gympie, Queensland, contain abundance of *Calcite* in strong veins and patches, often richly impregnated with *gold*. A fine specimen from there, in my possession, shows, besides solitary hackly grains, actual veins of largish *gold* specks irregularly distributed through white opaque *Calcite*.

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